INSTRUMENTS OF THE MONEY MARKET

The followng chapters were originally published in the seventh edition of *Instruments of the Money Market*, edited by Timothy Q. Cook and Robert K. Laroche. The information in this publication, although last revised in 1993 and no longer in print, is still frequently requested by academics, business leaders, and market analysts. Given the book's popularity, the Federal Reserve Bank of Richmond has made it available on the Internet.

Each chapter is available seperately below. For printing purposes a PDF file of the entire publication has been made available.

FOREWORD

This edition of *Instruments of the Money Market* contains two chapters on subjects that were not included in the sixth edition: over-the-counter interest rate derivatives and clearing and settling in the money market. All of the other chapters have been either completely rewritten or thoroughly revised to reflect developments in recent years.

All but three of the authors of the chapters in this edition were at the Federal Reserve Bank of Richmond when they wrote their chapters. Stephen A. Lumpkin is an economist at the Board of Governors of the Federal Reserve System. Jeremy G. Duffield is with The Vanguard Group of Investment Companies. Thomas K. Hahn is a financial consultant with TKH Associates.

Numerous market participants and Federal Reserve staff members generously provided information that was helpful in writing this edition of *Instruments of the Money Market.* These include Lawrence Aiken, Federal Reserve Bank of New York; Keith Amburgey, International Swap Dealers Association; Albert C. Bashawaty, Morgan Guaranty Trust Co.; Jackson L. Blanton, Federal Reserve Bank of Richmond; Richard S. Cohen, Chase Manhattan Bank, N. A.; Jerome Fons, Moody's Investors Service; David Humphrey, Florida State University; Ira G. Kawaller, Chicago Mercantile Exchange; Thomas A. Lawler, Federal National Mortgage Association; Patrick M. Parkinson, Board of Governors of the Federal Reserve System; Steen Parsholt, Citibank, N. A.; Mitchell A. Post, Board of Governors of the Federal Reserve System; David E. Schwartz, Mitsubishi Capital Market Services, Inc.; Robert J. Schwartz, Mitsubishi Capital Market Services, Inc.; David P. Simon, Board of Governors of the Federal Reserve System; James W. Slentz, Chicago Mercantile Exchange; Robert M. Spielman, Chase Manhattan Bank, N. A.; Bruce Summers, Federal Reserve Bank of Richmond; Walker Todd, Federal Reserve Bank of Cleveland; and Alex Wolman, University of Virginia.

We are especially grateful to staff members at the Federal Reserve Bank of Richmond who did such an excellent job in producing the book. Elaine Mandaleris, the Research Department's publications supervisor, provided critical support in the initial stages of the book's production and in the coordination of the staff. Dawn Spinozza, the managing editor for *Instruments,* did an exceptional job in editing the copy and organizing the ongoing production of the book. Gale (Geep) Schurman, the graphic artist, did an excellent job in producing the charts and design work. Lowell Brummett, the compositor, provided expert skill and judgment in putting together the final output.

Federal Reserve Bank of Richmond
Richmond, Virginia
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Chapter 1
THE MONEY MARKET

Timothy Q. Cook and Robert K. LaRoche

The major purpose of financial markets is to transfer funds from lenders to borrowers. Financial market participants commonly distinguish between the "capital market" and the "money market," with the latter term generally referring to borrowing and lending for periods of a year or less. The United States money market is very efficient in that it enables large sums of money to be transferred quickly and at a low cost from one economic unit (business, government, bank, etc.) to another for relatively short periods of time.

The need for a money market arises because receipts of economic units do not coincide with their expenditures. These units can hold money balances—that is, transactions balances in the form of currency, demand deposits, or NOW accounts—to insure that planned expenditures can be maintained independently of cash receipts. Holding these balances, however, involves a cost in the form of foregone interest. To minimize this cost, economic units usually seek to hold the minimum money balances required for day-to-day transactions. They supplement these balances with holdings of money market instruments that can be converted to cash quickly and at a relatively low cost and that have low price risk due to their short maturities. Economic units can also meet their short-term cash demands by maintaining access to the money market and raising funds there when required.

Money market instruments are generally characterized by a high degree of safety of principal and are most commonly issued in units of $1 million or more. Maturities range from one day to one year; the most common are three months or less. Active secondary markets for most of the instruments allow them to be sold prior to maturity. Unlike organized securities or commodities exchanges, the money market has no specific location. It is centered in New York, but since it is primarily a telephone market it is easily accessible from all parts of the nation as well as from foreign financial centers.

The money market encompasses a group of short-term credit market instruments, futures market instruments, and the Federal Reserve's discount window. The table summarizes the instruments of the money market and serves as a guide to the chapters in this book. The major participants in the money market are commercial banks, governments, corporations, government-sponsored enterprises, money market mutual funds, futures market exchanges, brokers and dealers, and the Federal Reserve.

Commercial Banks Banks play three important roles in the money market. First, they borrow in the money market to fund their loan portfolios and to acquire funds to satisfy noninterest-bearing reserve requirements at Federal Reserve Banks. Banks are the major participants in the market for federal funds, which are very short-term—chiefly overnight—loans of immediately available money; that is, funds that can be transferred between banks within a single business day. The funds market efficiently distributes reserves throughout the banking system. The borrowing and lending of reserves takes place at a competitively determined interest rate known as the federal funds rate.

Banks and other depository institutions can also borrow on a short-term basis at the Federal Reserve discount window and pay a rate of interest set by the Federal Reserve called the discount rate. A bank's decision to borrow at the discount window depends on the relation of the discount rate to the federal funds rate, as well as on the administrative arrangements surrounding the use of the window.

Banks also borrow funds in the money market for longer periods by issuing large negotiable certificates of deposit (CDs) and by acquiring funds in the Eurodollar market. A large denomination CD is a certificate issued by a bank as evidence that a certain amount of money has been deposited for a period of time—usually ranging from one to six months—and will be redeemed with interest at maturity. Eurodollars are dollar-denominated deposit liabilities of banks located outside the United States (or of International Banking Facilities in the United States). They can be either large CDs or nonnegotiable time deposits. U.S. banks raise funds in the Eurodollar market through their overseas branches and subsidiaries.

A final way banks raise funds in the money market is through repurchase agreements (RPs). An RP is a sale of securities with a simultaneous agreement by the seller to repurchase them at a later date. (For the lender—that is, the buyer of the securities in such a transaction—the agreement is often called a reverse RP.) In effect this agreement (when properly executed) is a short-term collateralized loan. Most RPs involve U.S. government securities or securities issued by government-sponsored enterprises. Banks are active participants on the borrowing side of the RP market.

A second important role of banks in the money market is as dealers in the market for over-the-counter interest rate derivatives, which has grown rapidly in recent years. Over-the-counter interest rate derivatives set terms for the exchange of cash payments based on subsequent changes in market interest rates. For example, in an interest rate swap, the parties to the agreement exchange cash payments to one another based on movements in specified market interest rates. Banks frequently act as middleman in swap transactions by serving as a counterparty to both sides of the transaction.

The Money Market

Instrument	Principal Borrowers
Federal Funds	Banks
Discount Window	Banks
Negotiable Certificates of Deposit (CDs)	Banks
Eurodollar Time Deposits and CDs	Banks
Repurchase Agreements	Securities dealers, banks, nonfinancial corporations, governments (principal participants)
Treasury Bills	U.S. government
Municipal Notes	State and local governments
Commercial Paper	Nonfinancial and financial businesses
Bankers Acceptances	Nonfinancial and financial businesses
Government-Sponsored Enterprise Securities	Farm Credit System, Federal Home Loan Bank System, Federal National Mortgage Association
Shares in Money Market Instruments	Money market funds, local government investment pools, short-term investment funds
Futures Contracts	Dealers, banks (principal users)
Futures Options	Dealers, banks (principal users)
Swaps	Banks (principal dealers)

A third role of banks in the money market is to provide, in exchange for fees, commitments that help insure that investors in money market securities will be paid on a timely basis. One type of commitment is a backup line of credit to issuers of money market securities, which is typically dependent on the financial condition of the issuer and can be withdrawn if that condition deteriorates. Another type of commitment is a credit enhancement—generally in the form of a letter of credit—that guarantees that the bank will redeem a security upon maturity if the issuer does not. Backup lines of credit and letters of credit are widely used by commercial paper issuers and by issuers of municipal securities.

Governments The U.S. Treasury and state and local governments raise large sums in the money market. The Treasury raises funds in the money market by selling short-term obligations of the U.S. government called Treasury bills. Bills have the largest volume outstanding and the most active secondary market of any money market instrument. Because bills are generally considered to be free of default risk, while other money market instruments have some default risk, bills typically have the lowest interest rate at a given maturity. State and local governments raise funds in the money market through the sale of both fixed- and variable-rate securities. A key feature of state and local securities is that their interest income is generally exempt from federal income taxes, which makes them particularly attractive to investors in high income tax brackets.

Corporations Nonfinancial and nonbank financial businesses raise funds in the money market primarily by issuing commercial paper, which is a short-term unsecured promissory note. In recent years an increasing number of firms have gained access to this market, and commercial paper has grown at a rapid pace. Business enterprises—generally those involved in international trade—also raise funds in the money market through bankers acceptances. A bankers acceptance is a time draft drawn on and accepted by a bank (after which the draft becomes an unconditional liability of the bank). In a typical bankers acceptance a bank accepts a time draft from an importer and then discounts it (gives the importer slightly less than the face value of the draft). The importer then uses the proceeds to pay the exporter. The bank may hold the acceptance itself or rediscount (sell) it in the secondary market.

Government-Sponsored Enterprises Government-sponsored enterprises are a group of privately owned financial intermediaries with certain unique ties to the federal government. These agencies borrow funds in the financial markets and channel these funds primarily to the farming and housing sectors of the economy. They raise a substantial part of their funds in the money market.

Money Market Mutual Funds and Other Short-Term Investment Pools

Short-term investment pools are a highly specialized group of money market intermediaries that includes money market mutual funds, local government investment pools, and short-term investment funds of bank trust departments. These intermediaries purchase large pools of money market instruments and sell shares in these instruments to investors. In doing so they enable individuals and other small investors to earn the yields available on money market instruments. These pools, which were virtually nonexistent before the mid-1970s, have grown to be one of the largest financial intermediaries in the United States.

Futures Exchanges Money market futures contracts and futures options are traded on organized exchanges which set and enforce trading rules. A money market futures contract is a standardized agreement to buy or sell a money market security at a particular price on a specified future date. There are actively traded contracts for 13-week Treasury bills, three-month Eurodollar time deposits, and one-month Eurodollar time deposits. There is also a futures contract based on a 30-day average of the daily federal funds rate.

A money market futures option gives the holder the right, but not the obligation, to buy or sell a money market futures contract at a set price on or before a specified date. Options are currently traded on three-month Treasury bill futures, three-month Eurodollar futures, and one-month Eurodollar futures.

Dealers and Brokers The smooth functioning of the money market depends critically on brokers and dealers, who play a key role in marketing new issues of money market instruments and in providing secondary markets where outstanding issues can be sold prior to maturity. Dealers use RPs to finance their inventories of securities. Dealers also act as intermediaries between other participants in the RP market by making loans to those wishing to borrow in the market and borrowing from those wishing to lend in the market.

Brokers match buyers and sellers of money market instruments on a commission basis. Brokers play a major role in linking borrowers and lenders in the federal funds market and are also active in a number of other markets as intermediaries in trades between dealers.

Federal Reserve The Federal Reserve is a key participant in the money market. The Federal Reserve controls the supply of reserves available to banks and other depository institutions primarily through the purchase and sale of Treasury bills, either outright in the bill market or on a temporary basis in the market for repurchase agreements. By controlling the supply of reserves, the Federal Reserve is able to influence the federal funds rate. Movements in this rate, in turn, can have pervasive effects on other money market rates. The Federal Reserve's purchases and sales of Treasury bills—called "open market operations"—are carried out by the Open Market Trading Desk at the Federal Reserve Bank of New York. The Trading Desk frequently engages in billions of dollars of open market operations in a single day.

The Federal Reserve can also influence reserves and money market rates through its administration of the discount window and the discount rate. Under certain Federal Reserve operating procedures, changes in the discount rate have a strong direct effect on the funds rate and other money market rates. Because of their roles in the implementation of monetary policy, the discount window and the discount rate are of widespread interest in the financial markets.

This book provides detailed descriptions of the various money market instruments and the markets in which they are used. Where possible, the book tries to explain the historical forces that led to the development of an instrument, influenced its pattern of growth, and led to new forms of the instrument. A major focus in the book is the Federal Reserve, which, in addition to its monetary policy role, plays an important role as a regulator in a number of the markets.

Much of the discussion in the book deals with the period from the late 1960s through the 1980s, which was one of particularly rapid change in the money market. Factors underlying this change include high and volatile interest rates, major changes in government regulations affecting the markets, and rapid technological change in the computer and telecommunications industries. These developments strongly influenced the pattern of growth of many money market instruments and stimulated the development of several new instruments.

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Chapter 2
FEDERAL FUNDS

Marvin Goodfriend and William Whelpley

Federal funds are the heart of the money market in the sense that they are the core of the overnight market for credit in the United States. Moreover, current and expected interest rates on federal funds are the basic rates to which all other money market rates are anchored. Understanding the federal funds market requires, above all, recognizing that its general character has been shaped by Federal Reserve policy. From the beginning, Federal Reserve regulatory rulings have encouraged the market's growth. Equally important, the federal funds rate has been a key monetary policy instrument. This chapter explains federal funds as a credit instrument, the funds rate as an instrument of monetary policy, and the funds market itself as an instrument of regulatory policy.

CHARACTERISTICS OF FEDERAL FUNDS

Three features taken together distinguish federal funds from other money market instruments. First, they are short-term borrowings of immediately available money—funds which can be transferred between depository institutions within a single business day. In 1991, nearly three-quarters of federal funds were overnight borrowings. The remainder were longer maturity borrowings known as term federal funds. Second, federal funds can be borrowed by only those depository institutions that are required by the Monetary Control Act of 1980 to hold reserves with Federal Reserve Banks. They are commercial banks, savings banks, savings and loan associations, and credit unions. Depository institutions are also the most important eligible lenders in the market. The Federal Reserve, however, also allows depository institutions to classify borrowings from U.S. government agencies and some borrowings from nonbank securities dealers as federal funds.[1]

[1] A more complete list of eligible lenders is found in Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin*, vol. 74 (February 1988), pp. 122-23.

Third, federal funds borrowed have historically been distinguished from other liabilities of depository institutions because they have been exempt from both reserve requirements and interest rate ceilings.[2]

The supply of and demand for federal funds arise in large part as a means of efficiently distributing reserves throughout the banking system. On any given day, individual depository institutions may be either above or below their desired reserve positions. Reserve accounts bear no interest, so banks have an incentive to lend reserves beyond those required plus any desired excess. Banks in need of reserves borrow them. The borrowing and lending take place in the federal funds market at a competitively determined interest rate known as the federal funds rate.

The federal funds market also functions as the core of a more extensive overnight market for credit free of reserve requirements and interest rate controls. Nonbank depositors supply funds to the overnight market through repurchase agreements (RPs) with their banks. Under an overnight repurchase agreement, a depositor lends funds to a bank by purchasing a security, which the bank repurchases the next day at a price agreed to in advance. In 1991, overnight RPs accounted for about 25 percent of overnight borrowings by large commercial banks. Banks use RPs to acquire funds free of reserve requirements and interest controls from sources, such as corporations and state and local governments, not eligible to lend federal funds directly. In 1991, total daily average gross RP and federal funds borrowings by large commercial banks were roughly $200 billion, of which approximately $135-140 billion were federal funds.

Competition among banks for funds ties the RP rate closely to the federal funds rate. The RP rate has historically been below the federal funds rate because RPs are collateralized, which makes them safer than federal funds, and because arranging RPs entails additional transactions costs. Data on RP rates paid by banks to their corporate customers are not available, but from 1983 to 1990 the dealer RP rate (the rate government security dealers pay to obtain funds through RPs) was around 20 to 25 basis points below the federal funds rate. For reasons we are unable to explain, the dealer RP rate was higher than the federal funds rate during most of 1991.

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[2] This distinction has been blurred since passage of the Depository Institutions Deregulation and Monetary Control Act of 1980. Reserve requirements are now maintained only on transaction deposits, and interest rate controls have been removed on all liabilities except traditional demand deposits. Interbank demand deposits, however, are still reservable and prohibited from paying interest. In addition, our definition should be qualified because repurchase agreements (RPs) at banks have not had interest rate ceilings or reserve requirements. Strictly speaking, such RPs are not federal funds. Yet as we explain below, their growth and use have had much in common with the federal funds market. The point of view of this chapter is that they are close functional equivalents.

METHODS OF FEDERAL FUNDS EXCHANGE

Federal funds transactions can be initiated by either the lender or the borrower. An institution wishing to sell (loan) federal funds locates a buyer (borrower) directly through an existing banking relationship or indirectly through a federal funds broker. Federal funds brokers maintain frequent telephone contact with active funds market participants and match purchase and sale orders in return for a commission. Normally, competition among participants ensures that a single funds rate prevails throughout the market. However, the rate might be tiered so that it is higher for a bank under financial stress. Moreover, banks believed to be particularly poor credit risks may be unable to borrow federal funds at all.

Two methods of federal funds transfer are commonly used. To execute the first type of transfer, the lending institution authorizes the district Reserve Bank to debit its reserve account and to credit the reserve account of the borrowing institution. Fedwire, the Federal Reserve System's wire transfer network, is employed to complete a transfer.

The second method simply involves reclassifying respondent bank demand deposits at correspondent banks as federal funds borrowed. Here, the entire transaction takes place on the books of the correspondent. To initiate a federal funds sale, the respondent bank simply notifies the correspondent of its intentions. The correspondent purchases funds from the respondent by reclassifying the respondent's demand deposits as "federal funds purchased." The respondent does not have access to its deposited money as long as it is classified as federal funds on the books of the correspondent. Upon maturity of the loan, the respondent's demand deposit account is credited for the total value of the loan plus an interest payment for use of the funds. The interest rate paid to the respondent is usually based on the nationwide average federal funds rate.

TYPES OF FEDERAL FUNDS INSTRUMENTS

The most common type of federal funds instrument is an overnight, unsecured loan between two financial institutions. Overnight loans are, for the most part, booked without a formal, written contract. Banks exchange oral agreements based on any number of considerations, including how well the corresponding officers know each other and how long the banks have mutually done business. Brokers play an important role by evaluating the quality of a loan when no previous arrangement exists. Formal contracting would slow the process and increase transaction costs. The oral agreement as security is virtually unique to federal funds.

Federal funds loans are sometimes arranged on a longer-term basis, e.g., for a few weeks. Two types of longer-term contracts predominate—term and continuing contract federal funds. A term federal funds contract specifies a fixed

term to maturity together with a fixed daily interest rate. It runs to term unless the initial contract explicitly allows the borrower to prepay the loan or the lender to call it before maturity.

Continuing contract federal funds are overnight federal funds loans that are automatically renewed unless terminated by either the lender or the borrower. This type of arrangement is typically employed by correspondents who purchase overnight federal funds from respondent banks. Unless notified by the respondent to the contrary, the correspondent will continually roll the interbank deposit into federal funds, creating a longer-term instrument of open maturity. The interest payments on continuing contract federal funds loans are computed from a formula based on each day's average federal funds rate. When a continuing contract arrangement is made, the transactions costs (primarily brokers fees and funds transfer charges) of doing business are minimized because after the initial transaction, additional costs are incurred only when the agreement is terminated by either party.

In some cases federal funds transactions are explicitly secured. In a secured transaction the purchaser places government securities in a custody account for the seller as collateral to support the loan. The purchaser, however, retains title to the securities. Upon termination of the contract, custody of the securities is returned to the owner. Secured federal funds transactions are sometimes requested by the lending institution.

DETERMINATION OF THE FEDERAL FUNDS RATE

To explain the determinants of the federal funds rate, we present a simple model of the market for bank reserves. In this model, which incorporates the actions of both private banks and the Federal Reserve, the funds rate is competitively determined as that value which equilibrates the aggregate supply of reserves with the aggregate demand for reserves.[3]

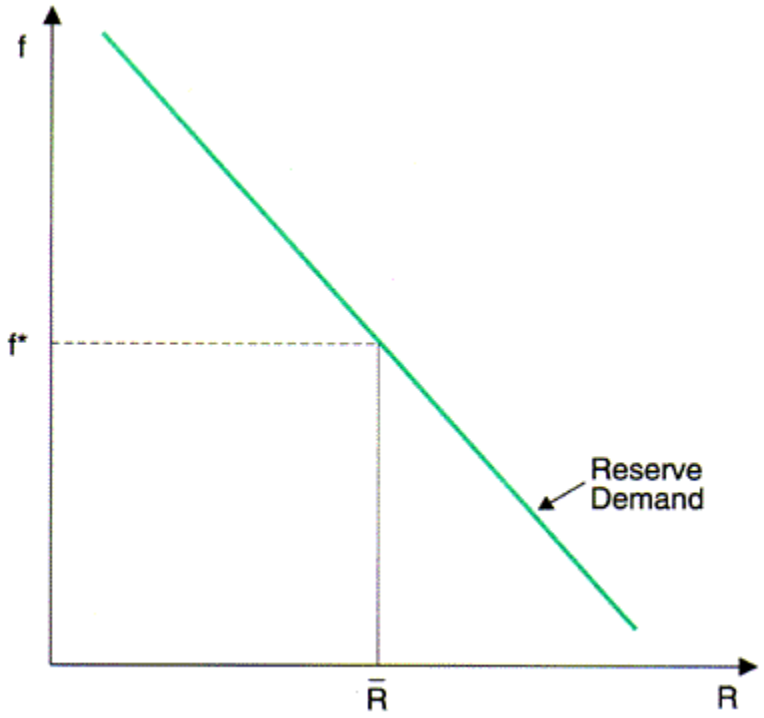
The aggregate demand for bank reserves arises from the public's demand for checkable deposits against which banks hold reserves. The aggregate quantity of checkable deposits demanded by the public falls as money market interest rates rise. Hence, the derived demand for bank reserves is negatively related to market interest rates. The aggregate demand schedule for bank reserves is shown in Figure 1, where f is the funds rate and R is aggregate bank reserves.[4]

The aggregate stock of reserves available to the banking system is determined by the Federal Reserve. In principle, the Federal Reserve could choose to provide

[3] Goodfriend 1982, pp. 3-16.

[4] The analysis here presumes that reserve demand is related contemporaneously to bank deposits. Required reserves were held on a lagged basis between 1968 and 1984, but they have been held contemporaneously since then. For a historical discussion of the role of reserve requirements in implementing monetary policy, see Goodfriend and Hargraves (1983).

FIGURE 1



the banking system with a fixed stock of reserves. If the Federal Reserve chose this strategy, a fixed stock of reserves, $\bar{R}$, would be provided through Federal Reserve purchases of government securities. The resulting funds rate would be f^* in Figure 1, or the rate that equilibrates the aggregate supply of and the aggregate demand for bank reserves.

Such a Federal Reserve operating procedure, known as total reserve targeting, is the focus of textbook discussions of monetary policy. The hallmark of total reserve targeting is that shifts in the market's demand for reserves are allowed to directly affect the funds rate. In practice, however, the Federal Reserve has never targeted total reserves. Instead, it has adopted operating procedures designed to smooth movements in the funds rate against unexpected shifts in reserve demand.[5] The simplest smoothing procedure is federal funds rate targeting, which involves selecting a narrow band, perhaps 50 basis points or less, within which the funds rate is allowed to fluctuate. Explicit federal funds rate targeting was employed by the Federal Reserve during the 1970s.

[5] Goodfriend (1991) analyzes interest rate smoothing and the conduct of monetary policy.

The funds rate can be targeted directly by supplying, through open market purchases of U.S. Treasury securities, whatever aggregate reserves are demanded at the targeted rate. For example, if the Federal Reserve chose to peg the funds rate at f^* in Figure 1, it would have to accommodate a market demand for reserves of $\bar{R}$. In principle, targeting either total reserves or the funds rate could yield the desired funds rate, f^*, so long as the Federal Reserve had precise knowledge of the position of the reserve demand locus.[6] There is, however, an important difference between these procedures. With a total reserve target, market forces directly influence the funds rate. They have no direct effect under a funds rate target. Instead, they affect only the volume of total reserves that the Federal Reserve must supply to support its chosen funds rate target.

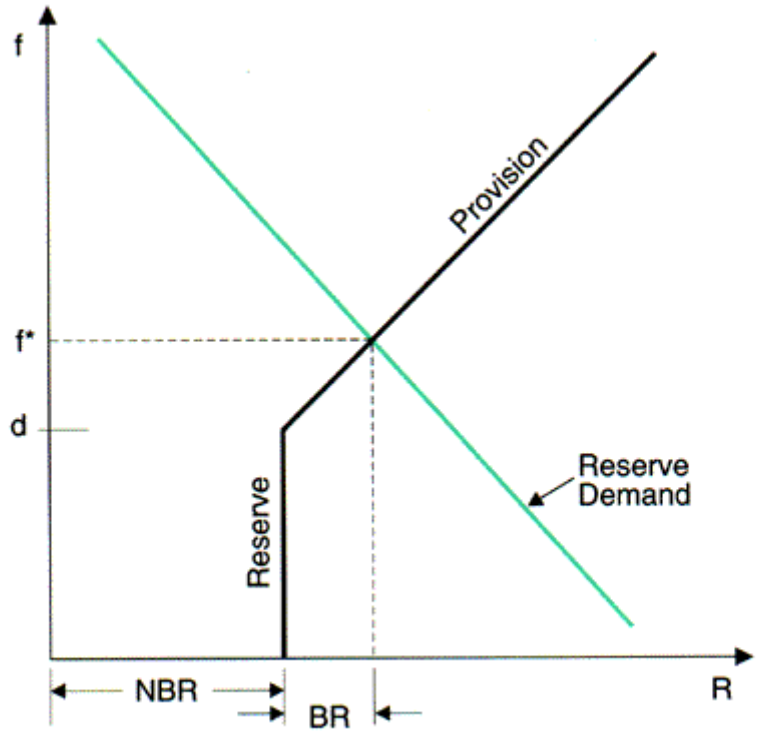
Federal Reserve operating procedures become more complicated when reserves are provided by bank borrowing at the Federal Reserve's discount window. Figure 2 shows the relationship between the provision of reserves and the federal funds rate when there is discount window borrowing. The locus has a vertical segment and a nonvertical segment because reserves are provided to the banking system in two forms, as nonborrowed and as borrowed reserves. Nonborrowed reserves (NBR) are supplied by the Federal Reserve through open market purchases, while borrowed reserves (BR) are provided by discount window lending.

The distance between the vertical segment of the reserve provision locus and the vertical axis is determined by the volume of nonborrowed reserves. The reserve provision locus is vertical up to the point where the funds rate (f) equals the discount rate (d) because, when the funds rate is below the discount rate, banks have no incentive to borrow at the discount window. Conversely, when the funds rate is above the discount rate, borrowers obtain a net saving on the interest cost of reserves. This net saving consists of the differential (f -d) between the funds rate and the discount rate. In administering the discount window the Federal Reserve imposes a noninterest cost of borrowing which rises with volume: higher borrowing increases the likelihood of costly Federal Reserve consultations with bank officials. Banks tend to borrow up to the point where the expected consultation cost of additional borrowing just offsets the net interest saving on that borrowing. Consequently, borrowing tends to be greater the larger the spread between the funds rate and the discount rate. Hence, the reserve provision locus is positively sloped for funds rates above the discount rate.

Discount window borrowing plays a role in determining the funds rate whenever the Federal Reserve restricts the supply of nonborrowed reserves so that the funds rate exceeds the discount rate. In that case, the banking system's demand for reserves is partially satisfied by borrowing at the discount window. If the

[6] Of course, the Federal Reserve never knows precisely the position of the reserve demand locus. Moreover, uncertainty about currency outflows from banks and fluctuations in Treasury balances at banks precludes exact control of total bank reserves by the Federal Reserve.

FIGURE 2



Federal Reserve chooses to keep nonborrowed reserves fixed in response to an unexpected shift in either reserve demand or the demand for discount window borrowing, then the procedure is called nonborrowed reserve targeting. Nonborrowed reserve targeting is a kind of cross between funds rate targeting and total reserve targeting in the sense that the reserve provision locus is diagonal, rather than horizontal or vertical, thereby partially smoothing the funds rate against shifts in aggregate reserve demand. The Federal Reserve experimented with nonborrowed reserve targeting between October 1979 and the fall of 1982. [7]

By contrast, the Federal Reserve may choose to respond to a shift in reserve demand or the demand for discount window borrowing by adjusting the provision of nonborrowed reserves to keep aggregate discount window borrowing unchanged. The latter procedure, known as borrowed reserve targeting, is closely related to funds rate targeting in that for a given level of the discount rate, targeting borrowed reserves determines the funds rate except for unpredictable instability due to shifts in the demand for discount window borrowing. The Federal Reserve has employed borrowed reserve targeting at times since late

[7] See Cook (1989).

1982, but it has often chosen borrowing objectives flexibly in order to keep the federal funds rate trading in a narrow range around a targeted rate. It employed free reserve targeting, a procedure analytically similar to borrowed reserve targeting, throughout the 1920s and in the 1950s and 1960s.[8]

As can be seen in Figure 2, the Federal Reserve's discount rate policy plays an important role in determining the funds rate when *f* is greater than *d* under either nonborrowed or borrowed reserve targeting. As is easily verified diagrammatically, with a borrowed reserve target an adjustment in the discount rate changes the funds rate one-for-one. The effect would be smaller with nonborrowed reserve targeting. Keep in mind, however, that the discount rate would be irrelevant for the determination of the funds rate if the Federal Reserve were to supply a stock of nonborrowed reserves sufficiently large so that the funds rate fell below the discount rate and banks had no incentive to borrow at the discount window. The discount rate is also irrelevant when the Federal Reserve targets the funds rate directly. Discount rate adjustments have played an important role since October 1979 in both the nonborrowed and borrowed reserve targeting periods, as they did in the 1920s, 1950s, and 1960s under free reserve targeting. In contrast, discount rate adjustments had no direct impact on the funds rate when the funds rate itself was targeted during the 1970s. In that period, however, the announcement effect associated with discount rate changes sometimes signaled Federal Reserve intentions to change the funds rate target in the future.[9]

THE FEDERAL RESERVE, THE FEDERAL FUNDS RATE, AND MONEY MARKET RATES

The Federal Reserve's operating procedures in the reserve market have varied greatly over the years. As we have seen, however, the Federal Reserve always has exercised a dominant influence on the determination of the federal funds rate through setting the terms upon which it makes nonborrowed and borrowed reserves available to the banking system.

The funds rate is the base rate to which other money market rates are anchored. Market participants determine money market rates according to their views of the current and future federal funds rates. As an example, consider bank certificates of deposit (CDs), which are generally arranged for a few months. A bank can raise funds by issuing a CD or by borrowing daily over the term of the CD through overnight federal funds and, therefore, chooses whichever option it expects to be cheaper. Likewise, a corporation considering the purchase of a Treasury bill has the option of lending its funds daily over the term of the bill at

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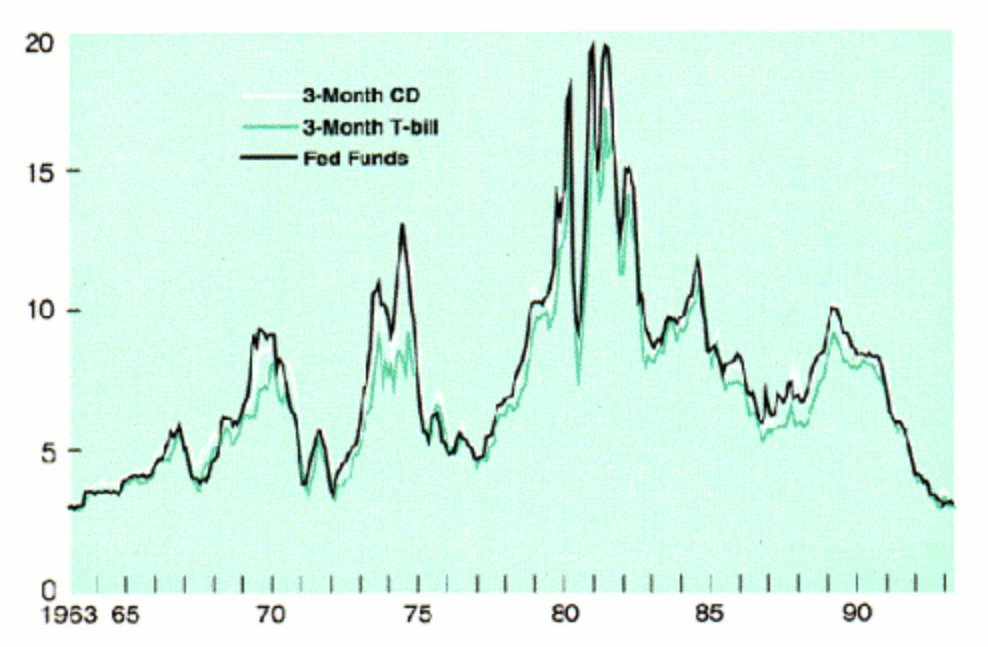
[8] Free reserves are defined as excess reserves minus borrowed reserves, or, equivalently, nonborrowed reserves minus required reserves.

[9] See Cook and Hahn (1988).

FIGURE 3

Short-Term Interest Rates

(Monthly Data)



the overnight repurchase rate, which is closely tied to the federal funds rate. It does whichever it expects will provide the highest return. As shown in Figure 3, such arbitrage keeps the yields of alternative money market instruments in line. Such considerations on the part of market participants make current and expected Federal Reserve policy toward the federal funds rate the key determinant of money market rates in general. Having made this point, we must realize that it provides only a partial explanation of money market rates. A full explanation requires an understanding of the Federal Reserve's monetary policy. In particular, economy-wide variables such as unemployment and inflation do ultimately play an important role in the evolution of the funds rate through their effect on the Federal Reserve's monetary policy actions over time.

HISTORY OF THE FEDERAL FUNDS MARKET

Federal funds were traded in New York as early as the summer of 1921, though trading volume was initially small, rarely exceeding $20 million a day.[10] By 1928

[10] Eccles 1982, p. 154.

the volume of federal funds trading had risen to $100 million per day. In April of that year an article appeared in the *New York Herald Tribune* announcing the inclusion of the federal funds rate in the *Tribune's* daily table of money market conditions.[11]

As the *Tribune* described it, a federal funds transaction involved the exchange of a check drawn on the clearinghouse account of the borrowing bank for a check drawn on the reserve account of the lending bank. The reserve check cleared immediately upon presentation at the Reserve Bank, while the clearinghouse check took at least one day to clear. The practice thereby yielded a self-reversing, overnight loan of funds at a Federal Reserve Bank; hence, the name federal funds. By 1930, the means of trading federal funds had expanded to include wire transfers and other methods.[12]

The emergence of federal funds trading constituted a financial innovation allowing banks to minimize transactions costs associated with overnight loans. By their very nature, federal funds could be lent by member banks only, since only member banks held reserves at Reserve Banks. The beneficiaries on the borrowing side were also member banks, which could receive funds immediately through their Reserve Bank accounts. Federal funds offered member banks a means of avoiding reserve requirements on interbank deposits if they could be classified as "money borrowed" rather than deposits.

In September 1928 the Federal Reserve Board ruled that federal funds created by the clearing of checks as described above should be classified as nonreservable money borrowed.[13] A decision in 1930 found that federal funds created by wire transfers and other methods should also be nonreservable.[14] These decisions provided the initial regulatory underpinnings for the federal funds market of today. In both the 1928 and 1930 rulings, the Board indicated that it viewed federal funds as a substitute for member bank borrowing at the Federal Reserve discount window. It argued that because discount window borrowing was not reservable, federal funds borrowing should not be either.

The Federal Reserve Board's decision to make federal funds nonreservable is best understood as a means of encouraging the federal funds market as an alternative to the two conventional means of reserve adjustment then in use: the discount window and the call loan market. Following World War I, aggregate borrowing at the Federal Reserve's discount window generally exceeded member bank reserves. At that time, the Federal Reserve did relatively little to discourage continuous borrowing at the window, so member banks could adjust

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[11] *New York Herald Tribune*, April 5, 1928, p. 30.

[12] Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin*, vol. 16 (February 1930), p. 81.

[13] Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin*, vol. 14 (September 1928), p. 656.

[14] See footnote 12.

their reserve positions directly with the Federal Reserve by running discount window borrowing up or down. In addition, banks had a highly effective means of reserve adjustment in the call loan market. Since the middle of the nineteenth century, banks had made a significant fraction of their loans to stock brokers, secured by stock or bond collateral on a continuing contract, overnight basis.[15] A bank could obtain reserves on demand by calling its broker loans, and it could readily lend excess reserves by issuing more broker loans. The call loan market was thus the functional equivalent of the federal funds market for reserve adjustment purposes.

During the 1920s, however, the Federal Reserve gradually discouraged both the discount window and the call loan market as means of reserve adjustment. Beginning in 1922, open market purchases limited borrowed reserves to less than one-third of total reserves.[16] Moreover, in an apparent effort to further reduce the highly visible subsidy that member banks received at the window, the Federal Reserve began actively discouraging continuous discount window borrowing by individual banks.[17] Both policy actions tended to make discount window borrowing less effective for routine reserve adjustment. This was particularly true for banks with undesired reserves because, with borrowing usually low or zero, they could not dispose of reserves by running down borrowings from the discount window. In addition, the Federal Reserve came to see the call loan market as an inappropriate means of financing speculation during the stock market boom of the late 1920s. It went so far as to bring "direct pressure" on individual banks to restrict call loans.[18]

The more restrictive discount policy and the discouragement of call lending increased the cost to banks of membership in the Federal Reserve System by raising the cost of reserve management. Since membership always has been voluntary, the Federal Reserve had to be concerned that the increased cost might prompt members to leave the System. To retain members, the Federal Reserve had an incentive to provide a substitute means of reserve adjustment. Making federal funds nonreservable did so by allowing member banks to obtain overnight interbank deposits free of reserve requirements.

Banking legislation in the 1930s further enhanced the attractiveness of federal funds. The Banking Act of 1933 prohibited explicit interest on demand deposits, including interbank demand deposits, but allowed banks to continue paying market interest on federal funds borrowed. This benefit was to prove particularly important in the high interest rate environment of the 1960s and

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[15] See Chapters 7 and 13 in Myers (1931).

[16] Board of Governors of the Federal Reserve System, *Banking and Monetary Statistics, 1914-1941*, pp. 368-96.

[17] Board of Governors of the Federal Reserve System, *Fifteenth Annual Report of the Federal Reserve Board Covering Operations for the Year 1928*, pp. 7-10.

[18] See the discussion in Friedman and Schwartz (1963), pp. 254-66.

1970s. The Securities and Exchange Act of 1934, in order to prevent excessive use of stock market credit, authorized the Federal Reserve Board to set margin requirements for both brokers and banks, and others if necessary, on loans collateralized by listed stocks and bonds. Relatively high margin requirements, coupled with other restrictions, brought about a permanent decline in the call loan market.[19]

Extremely low interest rates in the 1930s greatly reduced the interest opportunity cost of holding excess reserves. Consequently, banks held a large volume of excess reserves during this period and federal funds trading virtually disappeared. Federal Reserve pegging of Treasury bill rates between 1942 and 1947 rendered the funds market superfluous for reserve adjustment purposes. Under this policy the Federal Reserve freely converted Treasury securities into reserves at a fixed price. Therefore, banks could use their inventories of Treasury bills for reserve adjustment just as they had used their discount window borrowings in the early 1920s. The Federal Reserve stopped pegging the price of Treasury bills in 1947 and federal funds trading gradually reemerged as the most efficient means of reserve adjustment. In the 1950s, higher market interest rates increased the opportunity cost of holding excess reserves, making more frequent reserve adjustment necessary. Consequently, the volume of trading in federal funds grew sharply, with daily average gross purchases by large reserve city banks reaching about $800 million by the end of 1959.[20]

In the 1960s, the federal funds market began to take on a broader role beyond that of reserve adjustment. Banks made more extensive use of federal funds as a means of avoiding reserve requirements and the interest prohibition on demand deposits, both of which became more burdensome as interest rates rose throughout the period. Although the Federal Reserve was responsible for enforcing both of these legislative restrictions, it had to be concerned with offsetting the increased burden of membership in the System, and its actions during the period reflected this concern.[21]

The Board's first significant ruling with regard to the federal funds market in this period was its 1964 decision that a respondent bank, whether a member or not, could request a correspondent member bank to simply reclassify a deposit as federal funds, instead of having to transfer federal funds through a Reserve Bank account.[22] This ruling probably had its major effect on smaller respondent banks,

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[19]The historical margin requirement series is reported in Board of Governors of the Federal Reserve System, *Banking and Monetary Statistics.*

[20]Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin*, vol. 50 (August 1964), p. 954.

[21]Goodfriend and Hargraves (1983) document in detail how the membership problem dominated reserve requirement reform throughout this period. Required reserves have not been a disincentive for membership since the 1980 Monetary Control Act extended reserve requirements to nonmember institutions.

[22] Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin*, vol. 50 (August 1964), pp. 1000-1001.

who had previously found use of federal funds too costly for their relatively small transactions. Allowing banks to simply reclassify their correspondent balances as federal funds enabled smaller institutions to benefit from federal funds as large banks had already been doing. Moreover, it allowed member correspondent banks to compete more effectively for interbank funds, thereby reducing a disincentive to membership. Today, aggregate interbank deposits at large commercial banks are less than 20 percent of aggregate federal funds borrowings.

Banks in the 1960s also had a growing incentive to give their nonbank depositors access to nonreservable overnight instruments that paid a market rate of interest. Nonbanks had always been prohibited from participating in the federal funds market. But during the 1960s, widespread use of overnight RPs by banks became popular as a means of allowing their nonbank depositors to earn an overnight rate only slightly below the federal funds rate. RPs do not allow nonbanks to lend federal funds proper. However, because they allow nonbanks to approximately earn the federal funds rate, the RP market and the federal funds market together constitute a unified overnight loan market.

No one argued that nonbank depositors needed access to a relatively unregulated overnight instrument to manage their cash positions as banks did. Yet the need to facilitate reserve adjustment had been the original rationale for waiving reserve requirements and interest rate controls on federal funds. Nevertheless, the Federal Reserve chose not to make RPs at banks subject to reserve requirements or interest rate controls, probably because doing so would have worsened the competitive position of member banks relative to nonmembers and increased membership attrition.

It was necessary, however, to face up to two consequences of allowing banks to use RPs to attract funds. First, RPs were not covered by deposit insurance. Second, shifts from deposits to RPs reduced the volume of required reserves banks had to hold. This, in turn, reduced the volume of securities that the Federal Reserve could acquire for its portfolio, and thereby reduced the interest payments that it could transfer to the U.S. Treasury. A 1969 Federal Reserve rule restricting bank RP collateral to direct obligations of the U.S. government or its agencies, e.g., Treasury bills, responded to those concerns.[23] In principle, requiring RPs to be collateralized with liabilities of the United States made them free of default risk.[24] In addition, restricting bank RP paper exclusively to U.S. liabilities enhanced the demand for U.S. debt, offsetting somewhat the revenue lost due to the reduced volume of reserves held by banks.

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[23] Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin*, vol. 55 (August 1969), p. 655.

[24] Even if collateralized by U.S. government securities, as a legal matter RPs might also be subject to custodial risk due to incompletely specified contracts. See Ringsmuth (1985).

A 1970 Board ruling formally clarified eligibility for participation on the lending side of the federal funds market. Eligibility was restricted to commercial banks whether member or nonmember, savings banks, savings and loan associations, and others.[25] In effect, the ruling explicitly segmented the market for overnight credit into two classes of institutions, those that could lend federal funds and those that were required to pay somewhat more substantial transactions costs by lending through RPs. Because RPs are uneconomical for smaller transactions, smaller firms and households were unable to obtain market yields on overnight money until the emergence of money market mutual funds in the late 1970s.

CONCLUSION

It is interesting to note how far the federal funds market has come from its beginnings in the 1920s. Initially, the regulatory rationale for making federal funds nonreservable was to provide member banks with a means of reserve adjustment that could substitute for the discount window and the call loan market. Participation in the federal funds market was limited to member banks, i.e., banks holding required reserves at Reserve Banks. By the 1970s, however, that initial participation principle was effectively overturned. Nonbanks were not allowed to participate directly in the federal funds market, but they were allowed to earn approximately the federal funds rate through RPs at banks. Reserve adjustment obviously no longer provided a rationale for sanctioning access to an overnight loan market free of reserve requirements and interest rate controls. Rather, the granting of such access is better explained as a means by which, in order to minimize membership attrition, the Federal Reserve allowed member banks and their customers to avoid reserve requirements and the interest rate prohibition on overnight loans.

The federal funds market today, together with the RP market, is in many ways a functional equivalent of the call loan market of the 1920s and earlier. The most notable differences are that the nonbank portion of the market is now a net lender rather than a net borrower, and the collateral used is exclusively debt of the U.S. government and its agencies rather than private stocks and bonds. Like the old call loan market, the federal funds market of today facilitates the distribution of reserves among banks and serves as the core of an overnight credit market unencumbered by reserve requirements and legal restrictions on interest rates.

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[25] Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin*, vol. 56 (January 1970), p. 38. The current list of eligible lenders is given in the reference cited in footnote 1.

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The information in this chapter was last updated in 1993. Since the money market evolves very rapidly, recent developments may have superseded some of the content of this chapter.

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Chapter 3
THE DISCOUNT WINDOW

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The discount window refers to lending by each of the 12 regional Federal Reserve Banks to depository institutions. Discount window loans generally fund only a small part of bank reserves. For example, during 1990 and 1991, discount window loans averaged just over 1 percent of total reserves. Nevertheless, the window is perceived as an important tool for reserve adjustment, and at times it has been an important part of the Federal Reserve's monetary control procedures.

HOW THE DISCOUNT WINDOW WORKS

Discount window lending takes place through the reserve accounts depository institutions are required to maintain at their Federal Reserve Banks. In other words, banks borrow reserves at the discount window. This is illustrated in balance sheet form in Table 1. Suppose the funding officer at Bob's Bank finds it has an unanticipated reserve deficiency of $1 million and decides to go to the discount window for an overnight loan in order to cover it. Once the loan is approved, Bob's Bank's reserve account is increased by $1 million. This shows up on the asset side of Bob's balance sheet as an increase in "Reserves with Federal Reserve Bank," and on the liability side as an increase in "Borrowings from Federal Reserve Bank." The transaction also shows up on the Federal Reserve Bank's balance sheet as an increase in "Discounts and Advances" on the asset side and an increase in "Bank Reserve Accounts" on the liability side. This set of balance sheet entries takes place in all the examples given in the box.

The next day, Bob's Bank could raise the funds to repay the loan by, for example, increasing time deposits by $1 million or by selling $1 million of securities. In either case, the proceeds initially increase Bob's Bank's reserves. Actual repayment occurs when Bob's Bank's reserve account is reduced by $1 million, which erases the corresponding entries on Bob's liability side and on the Reserve Bank's asset side.

Discount window loans, which are granted to institutions by their district Federal Reserve Banks, can be either advances or discounts. All loans today are advances, meaning they are simply loans secured by approved collateral and paid back with interest at maturity. When the Federal Reserve System was established

TABLE 1

Borrowing From the Discount Window

Bob's Bank

Assets	**Liabilities**
Reserves with Federal Reserve Bank	Borrowings from Federal Reserve Bank
+$1,000,000	+$1,000,000

Federal Reserve Bank

Assets	**Liabilities**
Discounts and Advances	Bank Reserve Accounts
+$1,000,000	+$1,000,000

in 1914, however, the only loans authorized at the window were discounts, also known as rediscounts. Discounts involve a borrower selling "eligible paper," such as a commercial or agricultural loan made by a bank to one of its customers, to its Federal Reserve Bank. In return, the borrower's reserve account is credited for the discounted value of the paper. Upon repayment, the borrower gets the paper back, and its reserve account is debited for the value of the paper. In the case of either advances or discounts, the price of borrowing is determined by the level of the discount rate prevailing at the time of the loan.

Although discount window borrowing was originally limited to Federal Reserve System member banks, the Monetary Control Act of 1980 opened the window to all depository institutions that maintain transaction accounts (such as checking and NOW accounts) or nonpersonal time deposits. In addition, the Fed may lend to the U.S. branches and agencies of foreign banks if they hold deposits against which reserves must be kept. Finally, subject to a determination by the Board of Governors of the Federal Reserve System that "unusual and exigent circumstances" exist, discount window loans may be made to individuals, partnerships, and corporations that are not depository institutions. Such lending can take place only if the Board and the local Reserve Bank find that credit from other sources is not available and that failure to lend may have adverse effects on the economy. This last authority has not been used since the 1930s.

EXAMPLES OF DISCOUNT WINDOW TRANSACTIONS

Example 1 - It is reserve account settlement day (Wednesday) at a regional bank, and the bank is required to have enough funds in its reserve account at its Federal Reserve Bank to meet its reserve requirement over the previous two weeks. The bank finds that it must borrow in order to make up its reserve deficiency, but the money center (that is, the major New York, Chicago, and California) banks have apparently been borrowing heavily in the federal funds market, pushing the rate on federal funds far above its level earlier that day. As far as the funding officer of the regional bank is concerned, the market for funds at a price she considers acceptable has "dried up." She calls the Federal Reserve Bank for a discount window loan.

Example 2 - A West Coast regional bank, which generally avoids borrowing at the discount window, expects to receive a wire transfer of $300 million from a New York bank, but by late afternoon the money has not yet shown up. It turns out that the sending bank had, because of an error, accidentally sent only $3,000 instead of the $300 million. Although the New York bank is legally liable for the correct amount, it is closed by the time the error is discovered. In order to make up the deficiency in its reserve position, the West Coast bank calls the discount window for a loan.

Example 3 - It is reserve account settlement day at another bank, and the funding officer notes that the spread between the discount rate and fed funds rate has widened slightly. Since his bank is buying fed funds to make up a reserve deficiency, he decides to borrow part of the reserve deficiency from the discount window in order to take advantage of the spread. Over the next few months, this repeats itself until the bank receives an "informational" call from the discount officer at the Federal Reserve Bank, inquiring as to the reason for the apparent pattern in discount window borrowing. Taking the hint, the bank refrains from continuing the practice on subsequent Wednesday settlements.

Example 4 - A money center bank acts as a clearing agent for the government securities market. This means that the bank maintains book-entry securities accounts (see Chapter 13, "Clearing and Settlement of Money Market Instruments") for market participants and that it also maintains a reserve account and a book-entry securities account at its Federal Reserve Bank, so that it can clear securities transactions. One day, an internal computer problem arises that allows the bank to accept securities but not to process them for delivery to dealers, brokers, and other market participants. The bank's reserve account is debited for the amount of these securities, but it is unable to pass them on and collect payment for them, resulting in a growing overdraft in the reserve account. As the close of business approaches, it becomes increasingly clear that the problem will not be fixed in time to collect the required payments from the securities buyers. In order to avoid a negative reserve balance at the end of the day, the bank estimates its anticipated reserve account deficiency and goes to the Federal Reserve Bank discount window for a loan for that amount. The computer problem is fixed, and the loan is repaid the following day.

Discount window lending takes place under two main programs, adjustment credit and extended credit.[1] Adjustment credit consists of short-term loans extended to cover temporary needs for funds. Loans to large banks under this program are generally overnight loans, while small banks may take longer to repay. Under normal circumstances, adjustment credit should account for the larger part of discount window credit. Extended credit provides funds to meet longer-term requirements in one of three forms. First, seasonal credit can be extended to small institutions that depend on seasonal activities such as farming or tourism and that also lack ready access to national money markets. Second, extended credit can be granted to an institution facing special difficulties if it is believed that the circumstances warrant such aid. Finally, extended credit can go to groups of institutions facing deposit outflows due to changes in the financial system, natural disasters, or other problems common to the group. Borrowers under the seasonal program pay a rate tied to market rates. Borrowers under the second and third categories of extended credit initially pay the basic discount rate, but may pay a higher rate, generally 50 basis points higher than market rates, as the term of their borrowing grows longer.

The Federal Deposit Insurance Corporation Improvement Act of 1991 placed limits on the extent to which the Federal Reserve can lend to troubled depository institutions. Specifically, as of December 1993 the Act generally limits discount window loans to undercapitalized institutions to 60 days in any 120-day period and limits lending to critically undercapitalized institutions to a 5-day period after they are so identified. (These limits can be overcome in certain circumstances, especially if the appropriate federal banking agency or the Chairman of the Federal Reserve Board certifies to the lending Federal Reserve Bank that the borrowing institution is viable.) In order to borrow from the discount window, the directors of a depository institution first must pass a borrowing resolution authorizing certain officers to borrow from their Federal Reserve Bank. Next, the institution and the Reserve Bank draw up a lending agreement. These two preliminaries out of the way, the bank requests a discount window loan by calling the discount officer of the Reserve Bank and telling the amount desired, the reason for borrowing, and the collateral pledged against the loan. The discount officer then decides whether or not to approve it.

Collateral, which consists of securities that could be sold by the Reserve Bank if the borrower fails to pay back the loan, limits the Fed's (and therefore the taxpaying public's) risk exposure. Acceptable collateral includes, among other things, U.S. Treasury securities, government agency securities, municipal securities, mortgages on one- to four-family dwellings, and short-term commercial

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[1] For more detailed information on discount window administration policies, see *The Federal Reserve Discount Window,* Federal Reserve System (1990). The federal regulation governing the discount window is Regulation A, 12 CFR 201.

notes. Usually, collateral is kept at the Reserve Bank, although some Reserve Banks allow institutions with adequate internal controls to retain custody or to have the collateral maintained by a third-party custodian.

The discount rate is established by the Boards of Directors of the Federal Reserve Banks, subject to review and determination by the Board of Governors. If the discount rate were always set well above the prevailing federal funds rate, there would be little incentive to borrow from the discount window except in emergencies or if the funds rate for a particular institution were well above that for the rest of the market. Since the 1960s, however, the discount rate has more often than not been set below the funds rate. Figure 1, which portrays both adjustment credit borrowing levels and the spread between the two rates from 1955 through 1991, shows how borrowing historically tended to rise when the spread rose. In recent years adjustment borrowing has fallen off and become less sensitive to the spread. One likely explanation is that, because of troubles in the banking industry, banks have become more reluctant to go to the window for fear of giving the appearance that they are in financial trouble (Peristiani 1991).

The major nonprice tool for rationing discount window credit is the judgment of the Reserve Bank discount officer, whose job is to verify that lending is made only for "appropriate" reasons. Appropriate uses of discount window adjustment credit include meeting demands for funds due to unexpected withdrawals of deposits, avoiding overdrafts in reserve accounts caused by unexpected financial flows, and providing liquidity in case of computer failures (see box, Example 4), natural disasters, and other forces beyond an institution's control.[2]

An inappropriate use of the discount window would be borrowing to take advantage of a favorable spread between the federal funds rate and the discount rate (Example 3). Borrowing to fund a sudden, unexpected surge of demand for bank loans may be considered appropriate, but borrowing to fund a deliberate program of actively seeking to increase loan volume would not. Continuous borrowing at the window is inappropriate. Finally, an institution that is a net seller (lender) of federal funds should not at the same time borrow at the window, nor should one that is conducting reverse repurchase agreements (that is, lending money using securities as collateral).

The discount officer's judgment first comes into play when a borrower calls for a loan and states the reason. The monitoring does not end when (and if) the loan is approved, however. The discount officer watches for patterns in borrowing and may look at such summary measures as discount window loans as a percentage of deposits and of reserves, and duration and frequency of past borrowing. He or she pays attention to special circumstances and efforts to obtain credit elsewhere

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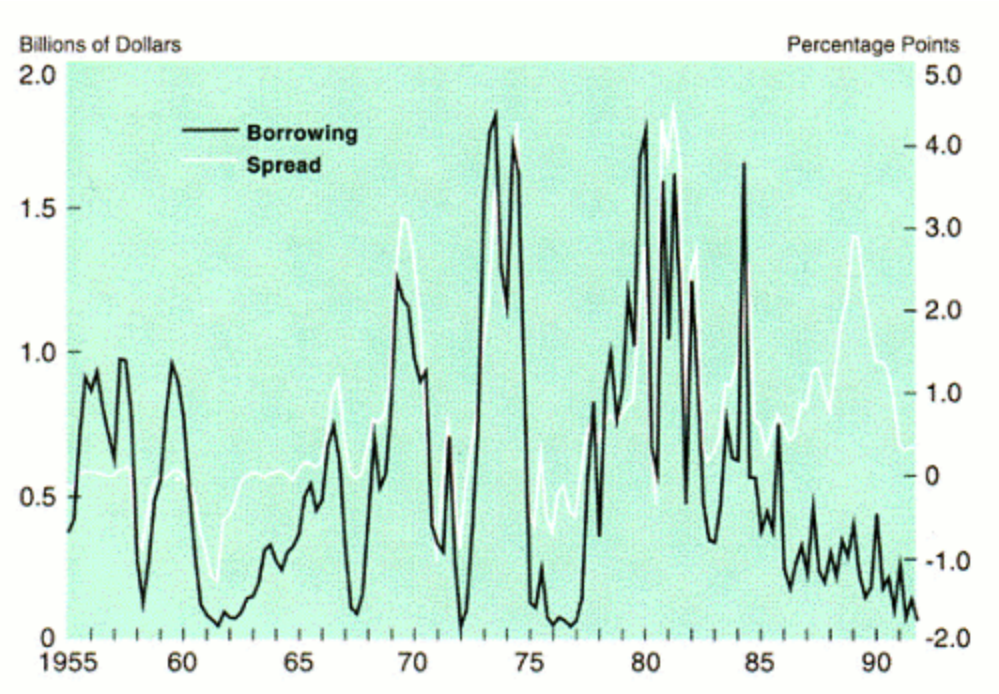
[2] In order to encourage depository institutions to take measures to reduce the probability of operating problems causing overdrafts, the Board of Governors announced in May 1986 that a surcharge would be added to the discount rate for large borrowings caused by operating problems unless the problems are "clearly beyond the reasonable control of the institution."

FIGURE 1



and compares discount window borrowings with fed funds market activity to make sure banks are not borrowing from the Fed simply to lend at a higher rate in the fed funds market.

If the discount officer suspects that borrowing by an institution has possibly gone beyond what is appropriate, he or she makes an "informational" call in order to find out the particular problems and circumstances of the case (Example 3), as well as how the institution plans to reduce its reliance on the discount window. If little or nothing changes, it may be time for counseling as well as a more direct effort to help the borrower find new sources of credit. It is conceivable that an institution's credit could be terminated if counseling were to fail, but this is rarely if ever necessary.

When deciding whether and how much to borrow from the discount window, a bank's funding officer can be expected to compare the benefit of using the discount window with the cost. The benefit of an additional dollar of discount window credit is the net interest saving, that is, the difference between the funds rate and the discount rate. The marginal cost is the cost imposed by nonprice measures used by the Fed to limit the amount of borrowing. An equilibrium level

of borrowing is reached when the marginal benefit of the net interest saving is balanced by the marginal cost imposed by nonprice measures (Goodfriend 1982, p. 4).

ANTECEDENTS

Two major nineteenth century writers argued that the most important function of a central bank is to act as lender of last resort to the financial system. The first major writer to detail the role of a lender of last resort was Henry Thornton at the beginning of the nineteenth century.[3] In today's terms, Thornton described a lender acting as a "circuit breaker," pumping liquidity into the market in order to prevent problems with particular institutions from spreading to the banking system as a whole. He emphasized that the lender of last resort's role in a panic is precisely opposite that of a private banker in that the former should expand lending in a panic while the latter contracts it. At the same time, Thornton did not advocate lending in order to rescue unsound banks, since that would send the wrong message to bankers, namely, that imprudent management would be rewarded with a bailout. Rather, he urged that loans be made only to banks experiencing liquidity problems due to the panic. In other words, the central bank has a responsibility to protect the banking system as a whole, but not to protect individual banks from their own mistakes.

The other major writer to deal with the subject was Walter Bagehot, who detailed his beliefs in *Lombard Street* in 1873. Generally, Bagehot agreed with Thornton, but developed the lender's role in far greater detail. His contribution is best summed up in the venerable Bagehot Rule: Lend freely at a high rate. This implies three points. First, the public should be confident that lending will take place in a panic, so that there is no question as to the central bank's commitment. Second, lending should go to anyone, not just banks, who presents "good" collateral, and collateral should be judged on what it would be worth in normal times, not on the basis of its temporarily reduced value due to a panic. Finally, borrowers should be charged a rate higher than prevailing market rates to ensure that central bank credit goes to those who value it highest, to encourage borrowers to look first to other sources of credit, to give borrowers incentives to pay back such credit as early as possible, and to compensate the lender for affording borrowers the insurance provided by a lender of last resort.

The ideas set forth by both Thornton and Bagehot emphasized emergency lending rather than adjustment credit. In actual practice, the Bank of England did act as lender of last resort several times during the late nineteenth century, but such lending was done in addition to its normal practice of providing adjustment

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[3] For a more detailed treatment of the material in this and the following paragraph, see Humphrey and Keleher (1984).

credit at the "bank rate." In the United States, the "real bills" doctrine was more influential in shaping the central bank than were the ideas of Thornton or Bagehot.[4]

The real bills or "commercial loan" school asserted that expansion of the money supply would not be inflationary so long as it was done to meet the "needs of trade." According to this school of thought, the central bank's task would be to expand discount window loans as production (and demand for money) expanded over the business cycle. Loans made by rediscounting commercial loans (which were considered to be made for "productive" purposes) would be self-liquidating, since they would be paid back as the goods produced were sold on the market. The money supply increase would consequently be extinguished.[5] Reflecting the influence of the real bills doctrine, the Preamble to the Federal Reserve Act of 1913 included as a stated purpose "to furnish an elastic currency." Accordingly, the Act contained provisions for the rediscounting of bank loans "arising out of actual commercial transactions" and it defined what paper was eligible for rediscount.

EVOLUTION OF DISCOUNT WINDOW PRACTICES

The only type of lending allowed Federal Reserve Banks by the Federal Reserve Act of 1913 was discounting. In 1916 Congress amended the Act to add the authority for Federal Reserve Banks to lend to member banks by making advances secured by eligible paper or by Treasury securities. Advances replaced discounts in practice during 1932 and 1933, when the volume of banks' eligible paper fell precipitously as the result of the general banking contraction taking place at the time. Emphasis on lending on the basis of "productive" loans gave way to concern with whether or not collateral offered to secure an advance, be it commercial notes or government securities, was sound enough to minimize risk to the Fed. Since then, advances have been the predominant form of discount window lending.

The Fed firmly established nonprice rationing of discount window credit as a matter of practice during the late 1920s. In accordance with the real bills doctrine's stress on "productive" uses of credit, the Fed already discouraged the use of the discount window to finance "speculative" investments, but other reasons for lending came to receive its disapproval. For example, in 1926 the Board adopted a policy of discouraging continuous borrowing from the discount window. In 1928, it specifically stated that banks should not borrow from the window for profit. Since then, the Fed has emphasized nonprice measures along with the discount rate to control borrowing.

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[4] The lender of last resort idea did surface in the practice of some American clearinghouses acting as emergency lenders during panics. See Gorton (1984).

[5] For a demonstration of the fallaciousness of the real bills doctrine, see Humphrey (1982).

Because market rates were well below the discount rate, banks used the discount window sparingly between 1933 and 1951. Daily borrowings averaged only $11.8 million from 1934 to 1943, and only $253 million from 1944 to 1951. For the most part, banks held large amounts of excess reserves and were under little pressure to borrow. Even after the business recovery of the early 1940s, borrowing remained at low levels. Banks held large quantities of government securities, and the Federal Reserve's practice of pegging the prices of these securities, instituted in 1942, eliminated the market risk of adjusting reserve positions through sales of government securities.

The pegged market for government securities ended in 1947, and the subsequent increased fluctuations of their prices made buying and selling them a riskier way for banks to adjust reserves. As a result, the discount window began to look more attractive as a source of funds, and by mid-1952 borrowings exceeded $1.5 billion, a level not seen since the early 1930s. Given the new importance of the window, the Board in 1955 revised its Regulation A, which governs discount window credit, to incorporate principles that had developed over the past 30 years. In particular, the General Principles at the beginning of Regulation A stated that borrowing at the discount window is a privilege of member banks and for all practical purposes enshrined nonprice rationing and the discretion of the discount officer regarding the appropriateness of borrowing as primary elements of lending policy.

The new version of Regulation A notwithstanding, the discount rate was for the most part equal to or greater than the federal funds rate during the late 1950s and early 1960s, so banks had little financial incentive to go to the window. By the mid-1960s, however, the difference between the federal funds rate and the discount rate began to experience large swings, and the resulting fluctuations in incentives to borrow were reflected in discount window credit levels (see Figure 1).

In 1973, the Board expanded the range of permissible discount window lending by creating the seasonal credit program. More significantly, in 1974 the Fed advanced funds to Franklin National Bank, which had been experiencing deteriorating earnings and massive withdrawals. The advance was made to avoid potentially serious strains on the financial system if the bank were allowed to fail and to buy time to find a longer-term solution. This particular situation was resolved by the takeover of the bulk of the bank's assets and deposits by European American Bank, but the significant event here was the lending to a large, failing bank in order to avert what were perceived to be more serious consequences for the banking system. The action set a precedent for lending a decade later to Continental Illinois until a rescue package could be put together.

Reflecting a discount rate substantially below the federal funds rate from 1972 through most of 1974, discount window borrowings grew to levels that were high by historical standards. A recession in late 1974 and early 1975 drove loan demand

down, and market rates tended to stay below the discount rate until mid-1977. During the late 1970s, the spread was positive again, and borrowing from the window increased. The spread became highly volatile in the early 1980s, largely as a consequence of the operating procedures for monetary policy (described below) that were in place during this period. Borrowing became more volatile as well. As was mentioned above, in recent years, borrowing has been low and relatively insensitive to changes in the spread.

The Monetary Control Act of 1980 extended to all banks, savings and loan associations, savings banks, and credit unions holding transactions accounts and nonpersonal time deposits the same borrowing privileges as Federal Reserve member banks. Among other things, the Act directed the Fed to take into consideration "the special needs of savings and other depository institutions for access to discount and borrowing facilities consistent with their long-term asset portfolios and the sensitivity of such institutions to trends in the national money markets." Although thrift institutions may borrow from the Fed, the Fed normally expects them to go first to their own special industry lenders for help before coming to the window.

THE ROLE OF THE DISCOUNT WINDOW IN MONETARY POLICY

Since the early 1970s, the Federal Reserve has used several different procedures to control the growth rate of the money supply.[6] In these procedures, there is an important distinction between borrowed reserves and nonborrowed reserves. Borrowed reserves come from the discount window, while nonborrowed reserves are supplied by Fed open market operations. The Fed can directly control nonborrowed reserves, but the demand for borrowed reserves is related to the spread between the funds rate and the discount rate.

During the 1970s, the Fed followed a policy of targeting the federal funds rate at a level it believed to be consistent with the level of money stock desired. It conducted open market operations in order to keep the funds rate within a narrow range, which in turn was selected to realize the money growth objective set by the Federal Open Market Committee. Under this practice of pegging the fed funds rate in the short run, changes in the discount rate affected only the spread between the two rates and therefore the division of total reserves between borrowed and nonborrowed reserves. For example, if the Fed raised the discount rate while the federal funds rate remained above the discount rate, borrowing reserves from the Fed would become relatively less attractive than going into the federal funds market. This would decrease the quantity demanded of borrowed

[6] These procedures are described in more detail by Gilbert (1985) and Broaddus and Cook (1983) and are analyzed along with other possible operating procedures in Goodfriend (1982).

reserves but would increase demand for their substitute, nonborrowed reserves, thereby tending to put upward pressure on the funds rate. Given the policy of pegging the funds rate, however, the Fed would increase the supply of nonborrowed reserves by purchasing securities through open market operations. The result would be the same federal funds rate and total reserves as before, but more nonborrowed relative to borrowed reserves.[7]

On October 6, 1979, the Federal Reserve moved from federal funds rate targeting to nonborrowed reserves targeting. Under the prevailing system of lagged reserve requirements, required reserves were taken as given since they were determined on the basis of bank deposits held two weeks earlier. Consequently, once the Fed decided on a target for nonborrowed reserves, a level of borrowed reserves was also implied. Again assuming discount rates below the federal funds rate, an increase in the discount rate would decrease the spread between the federal funds rate and the discount rate. Since this would decrease the incentive to borrow, demand would increase for nonborrowed reserves in the federal funds market. Under the new procedure the target for nonborrowed reserves was fixed, however, so the Fed would not inject new reserves into the market. Consequently, the demand shift would cause the funds rate to increase until the original spread between it and the discount rate returned. The upshot here is that, since discount rate changes generally affected the federal funds rate, the direct role of discount rate changes in the operating procedures increased after October 1979.

In October 1982, the Federal Reserve moved to a system of targeting borrowed reserves. Under this procedure the Federal Open Market Committee periodically specifies a desired degree of "reserve restraint." More restraint means a higher level of borrowing. Open market operations are conducted to provide the level of nonborrowed reserves consistent with the desired level of borrowed reserves and the demand for total reserves. A discount rate increase under this procedure initially shrinks the spread between the federal funds rate and discount rate, and shifts demand toward nonborrowed reserves. In order to preserve the targeted borrowing level, the funds rate changes by about the same amount as the discount rate so that the original spread is retained. As a result, discount rate changes under borrowed reserves targeting affect the funds rate the same as under nonborrowed reserves targeting.

In the late 1980s and early 1990s, the Federal Reserve partially reverted to the operating procedures it had used in the 1970s, as it began to place less weight on achieving a particular level of borrowed reserves and greater weight on keeping the funds rate in a fairly narrow range. In this period the link between the discount and funds rates weakened somewhat. At times, changes in the discount rate were

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[7] Although under this procedure discount rate changes did not directly affect the funds rate, some discount rate changes signaled subsequent funds rate changes. See Cook and Hahn (1988).

followed by smaller changes in the funds rate, as some of the effect on the funds rate was offset by a change in the borrowed reserves target.

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The information in this chapter was last updated in 1993. Since the money market evolves very rapidly, recent developments may have superseded some of the content of this chapter.

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Chapter 4
LARGE NEGOTIABLE CERTIFICATES OF DEPOSIT

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Since the early 1960s large denomination ($100,000 or more) negotiable certificates of deposit (CDs) have been used by banks and other depository institutions as a source of purchased funds and as a means of managing their liability positions. Large negotiable CDs have also been an important component of the portfolios of money market investors. As of the end of 1992 outstanding large CDs at large banks were $114 billion.[1]

Large CDs are generally divided into four classes based on the type of issuer because the rates paid, risk, and depth of the market vary considerably among the four types. The oldest of the four groups consists of CDs issued by U.S. banks domestically, which are called domestic CDs. Dollar-denominated CDs issued by banks abroad are known as Eurodollar CDs or Euro CDs. CDs issued by U.S. branches of foreign banks are known as Yankee CDs. Finally, CDs issued by savings and loan associations and savings banks are referred to as thrift CDs.

DOMESTIC CDS

A certificate of deposit is a document evidencing a time deposit placed with a depository institution. The certificate states the amount of the deposit, the date on which it matures, the interest rate and the method under which the interest is calculated. Large negotiable CDs are generally issued in denominations of $1 million or more.

A CD can be legally negotiable or nonnegotiable, depending on certain legal specifications of the CD. Negotiable CDs can be sold by depositors to other

[1] The Federal Reserve stopped collecting weekly data on large negotiable CDs from all large weekly reporting banks as of January 1984. The Federal Reserve, however, continued to collect monthly data on negotiable CDs from the largest (banks with assets greater than $5 billion) of the large weekly reporters through June 1987. Since June 1987, the Federal Reserve has collected data only for all large CDs, a classification that includes both negotiable and nonnegotiable CDs. Throughout this chapter the amount of large CDs outstanding at large weekly reporting banks will be used as a proxy for large **negotiable** CDs of domestic banks. As of June 1987 approximately 70 percent of the largest banks' large CDs were negotiable.

parties who can in turn resell them. Nonnegotiable CDs generally must be held by the depositor until maturity. During the late 1970s and early to mid-1980s, between 60 and 80 percent of large CDs issued by large banks were negotiable instruments. The Federal Reserve stopped collecting separate data on negotiable CDs in 1987.

A CD may be payable to the bearer or registered in the name of the investor. Most large negotiable CDs are issued in bearer form because investors can resell bearer CDs more easily. Registration adds complication and costs to the process of transferring ownership of CDs. Under the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA), CDs with original maturities of more than one year must be registered.

Federal banking agency regulations limit the minimum maturity of a time deposit to seven days. Most CDs have original maturities of 1 to 12 months, although some have maturities as long as five years or more. Approximately half of the large CDs issued domestically by U.S. banks that were outstanding at the end of December 1992 had a maturity of three months or less.

Interest rates on CDs are generally quoted on an interest-bearing basis with the interest computed on the basis of a 360-day year. A $1 million, 90-day CD with a 3 percent annual interest rate would after 90 days entitle the holder of the CD to:

$$\$1{,}000{,}000 \times [1 + (90/360) \times 0.03] = \$1{,}007{,}500.$$

This method of calculating interest is known as "CD basis," "actual/360 basis," or "365/360 basis." At some banks, however, interest on CDs is computed on the basis of a 365-day year. When calculated on a 365-day year basis a $1 million, 90-day CD would have to pay a stated rate of 3.04 percent to offer the holder a return equivalent to a CD that paid 3 percent on a CD basis:

$$\$1{,}000{,}000 \times [1 + (90/365) \times 0.0304] = \$1{,}007{,}500.$$

Banks usually pay interest semiannually on fixed-rate CDs with maturities longer than one year, although the timing of interest payments is subject to negotiation.

Variable-Rate CDs Variable-rate CDs (VRCDs), also called variable-coupon CDs or floating-rate CDs, have been available in the United States since 1975 from both domestic banks and the branches of foreign banks. VRCDs have the distinguishing feature that their total maturity is divided into equally long rollover periods, also called legs or roll periods, in each of which the interest rate is set anew. The interest accrued on a leg is paid at the end of that leg.

The interest rate on each leg is set at some fixed spread to a certain base rate which is usually either a composite secondary market CD rate, a Treasury bill rate, LIBOR, or the prime rate. The maturity of the instrument providing the base rate is equal in length to that of the leg. For example, the interest rate on a VRCD

with a one-month roll might be reset every month with a fixed spread to the composite one-month secondary market CD rate. The most popular maturities of VRCDs are 18 months and two years, and the most popular roll periods are one and three months.

VRCDs are used by issuing banks because they improve their liquidity positions by providing funds for relatively long periods. VRCDs are purchased by money market investors who want to invest in instruments with long-term maturities but wish to be protected from loss if interest rates increase. The largest investors in VRCDs are money market funds. Money market funds are allowed by SEC regulations to treat their holdings of VRCDs as if they had maturities equal to the length of the roll.

Throughout much of the 1980s VRCDs accounted for 10 percent or more of outstanding large CDs. The percentage fell rapidly in the 1990s, however, and as of December 1992 VRCDs were only about 2 percent of outstanding large CDs. This decline may have resulted from a diminished concern of investors with the risk of rising inflation and therefore rising interest rates.

Issuing Banks Only money center banks and large regional banks are able to sell negotiable CDs in the national market. Large CDs perform two important functions for these banks. First, large CDs can be issued quickly to fund new loans. Second, they enable banks to limit their exposure to interest rate risk that can arise when there is a difference between the interest rate sensitivity of their assets and their liabilities. For example, a bank may find that on average its assets mature or reprice every nine months while its liabilities mature or reprice every six months. Should interest rates rise, this bank's interest earnings on its assets would rise more slowly than its cost of funds so that its net income would decline. To limit this risk, the bank may increase the average maturity of its liabilities by issuing fixed-rate, negotiable CDs with maturities of one year.

Deposit Notes and Bank Notes In the mid-1980s a number of large U.S. banks began issuing deposit notes and bank notes. Deposit notes are essentially equivalent to negotiable CDs. They are negotiable time deposits, generally sold in denominations of $1 million, have federal deposit insurance covering only $100,000 of the deposit, are sold largely to institutional investors, and normally carry a fixed rate of interest. Deposit notes differ from most negotiable CDs by calculating their interest payments in the same manner as on corporate bonds.

Banks began issuing deposit notes in an attempt to appeal to investors who typically invested in medium-term corporate bonds, so they have maturities in the 18-month to five-year range. U.S. branches of foreign banks are major issuers of deposit notes. There are no data available on outstanding amounts of deposit notes since these notes are reported by banks as large CDs on financial statements to federal regulators.

Bank notes were developed by banks as a way to gather funds not subject to federal deposit insurance premiums. Bank notes are identical to deposit notes except that they are not reported as deposits on issuing banks' financial statements. Instead bank notes are reported along with several other liabilities as "borrowed money." There is no data available on the outstanding amounts of bank notes.

History and Recent Development of Domestic CDs After World War II, rising interest rates led corporations to limit their demand deposit balances, which paid no interest. Demand deposits and currency as a percentage of total financial assets of nonfinancial corporate businesses declined from 29 percent in 1946 to 16 percent in 1960 (Board of Governors 1986, *Flow of Funds Accounts,* pp. 73-74). To replace the lost corporate demand deposits and to attract new deposits from the money market, banks began in 1961 to sell large negotiable CDs.

At the same time that First National City Bank of New York (now Citibank) began issuing large negotiable CDs, the Discount Corporation of New York, a government securities dealer, agreed to make a secondary market in large CDs. Soon other major New York banks began offering large CDs and other leading government securities dealers began making a market in outstanding CDs. Within a year of the initial issue of negotiable CDs by First National City Bank, domestic negotiable CDs outstanding exceeded $1 billion.[2]

During its first decade, the CD market grew rapidly except for two major setbacks. In 1966, and more severely in 1969 and early 1970, domestic CDs outstanding fell dramatically when open market interest rates rose above Regulation Q ceiling rates on large time deposits set by the Federal Reserve. Both times the binding interest rate ceilings reflected the policy of the Federal Reserve to slow the growth in bank loans.

Since banks were unable to raise funds by issuing domestic CDs, they turned to the Eurodollar and commercial paper markets as additional sources of funds. Businesses also raised money by issuing commercial paper. After the failure of the Penn Central Transportation Company in June 1970, however, some borrowers found it difficult to issue commercial paper. The Federal Reserve eliminated interest rate ceilings on large CDs with maturities of less than three months so that banks could return to the domestic CD market and thereby fund loans to businesses that were having difficulty issuing commercial paper. In 1973 the Federal Reserve also dropped the ceilings on rates of large CDs with longer maturities. Ceilings on rates of large CDs have not been imposed since then.

With the exception of the period from 1974 through 1976 when loan demand was low because of a recession, large CDs outstanding grew fairly steadily

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[2] Detailed expositions of the origin of the domestic CD market are given in Brewer (1963), Fieldhouse (1962), and Treadway (1965).

from the early 1970s until 1982 (see Figure 1). An important factor behind the growth during the late 1970s was the emergence of money market funds (MMFs). Although interest rate ceilings were eliminated in 1973 on large time deposits in amounts of $100,000 or more, they continued to exist for smaller time and savings deposits. In the late 1970s interest rates rose above these ceiling rates and stayed above them for several years. Small investors were able to circumvent the regulatory ceilings and earn a market rate of interest by investing in MMFs, which pooled the savings of many small investors in order to invest in money market instruments. MMFs grew rapidly from only $10 billion in 1978 to $206 billion in 1982, and a large part of their assets were CDs.

To counter the outflow of savings balances from banks into MMFs, Congress authorized banks and thrifts to offer two ceiling-free accounts: the Money Market Deposit Account (MMDA) and the Super NOW. The MMDA was introduced in December 1982 and the Super NOW in January 1983. These accounts, especially the MMDA, proved to be very popular, and by year-end 1983 they had attracted more than $400 billion to commercial banks and thrifts. Some of this money came from MMFs, the total assets of which fell by $46 billion in 1983. The rapid inflow of funds into MMDAs and Super NOWs led banks to cut back on their issuance of large CDs. CDs outstanding at large weekly reporting banks fell $70 billion from their peak in late 1982 to $140 billion at year-end 1983. MMFs' holdings of domestic CDs fell in 1983 from $36 billion to $22 billion.

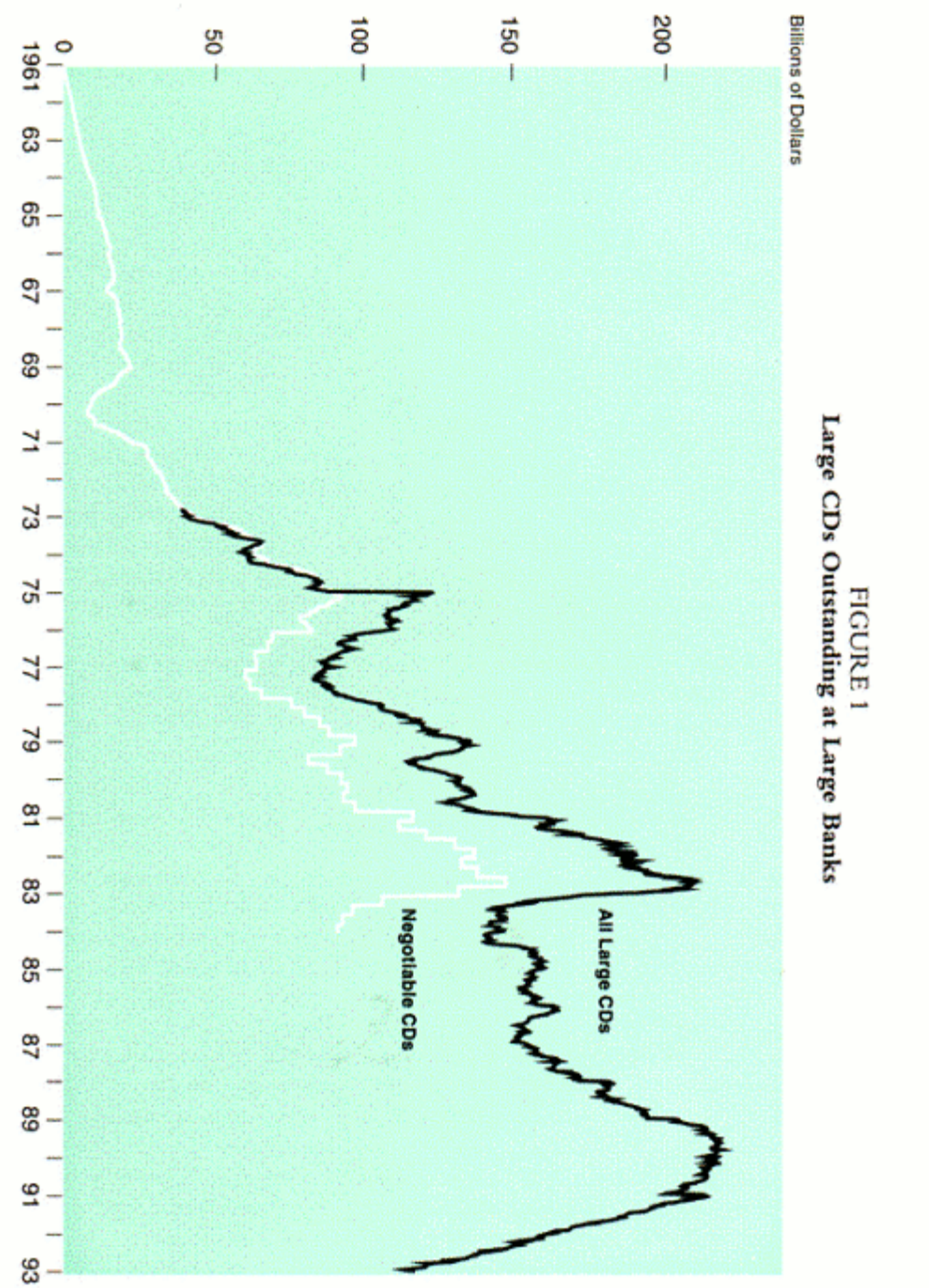
From 1984 until 1990 the amount of large CDs at large banks increased fairly consistently as bank loans and the overall economy grew through the period. As demand for bank loans diminished and bank loan losses expanded on account of the recession that began in 1990, banks began to issue fewer large CDs. Increased capital requirements of the late 1980s and early 1990s also caused some of the largest U.S. banks to slow their asset growth or even to shrink, reducing their need for CD funding. The combination of these factors led to the very significant decline in large CD outstandings at large weekly reporting banks from a peak of $215 billion in early 1991 to $114 billion at the end of 1992.

EURODOLLAR CDS

Eurodollar CDs are dollar-denominated CDs issued by the foreign branches of U.S. banks or by foreign banks located abroad. Eurodollar CDs are negotiable instruments and are usually quoted on an interest-bearing basis. They are primarily issued in London and therefore frequently termed London dollar CDs.

The London branch of First National City Bank of New York issued the first Eurodollar CD in 1966. At the time, market interest rates in the United States were above Reg Q interest rate ceilings, giving banks the incentive to raise funds overseas where there were no interest rate ceilings. Eurodollar deposits also were free of reserve requirements while domestic CD deposits were not.

FIGURE 1
Large CDs Outstanding at Large Banks



Most Eurodollar CDs are fixed-rate, typically with maturities from three to six months. Floating-rate Eurodollar CDs are also issued, usually with longer maturities. Some Eurodollar CDs, known as "Tranche" CDs, are issued in large aggregate amounts (usually between $10 million and $30 million) and then divided, by dealers, into a number of smaller ($10,000-$25,000) certificates. These smaller certificates can then be sold through brokers, investment banks, or an issuing bank's retail sales operation. All of the smaller CDs from a single initial issuance have the same interest rate, issue date, interest payment dates, and maturity.

Eurodollar CDs are sold mostly to institutional investors and large corporations in the United States. Eurodollar CDs are also sold to other banks in the London interbank market.

The major issuers of Eurodollar CDs are the branches of major U.S., Japanese, Canadian, continental banks, and the British clearing banks. While there are no data available on the amount of Eurodollar CDs outstanding, there are data on all foreign currency CDs outstanding in London, the majority of which are Eurodollar CDs (Federal Reserve Bank of New York 1989, p. 15).[3] Table 1 shows the amount of London foreign currency CDs outstanding (i.e., the amount of London CDs not denominated in pounds). Both the amount of London foreign currency CDs issued by U.S. banks and their portion of the market fell steadily from late 1982 to 1991. Japanese banks and other overseas banks replaced banks from the United States as the largest issuers of Euro CDs.

The decline in Eurodollar CDs issued by U.S. banks can be attributed to three factors. The inflow of new retail funds into MMDA and Super NOW accounts in the United States reduced the need to fund with Eurodollar CDs. U.S. banks also significantly reduced their international lending following the international debt crisis of 1982. And the near failure of Continental Illinois in 1984 made international investors wary of large U.S. banks' CDs.

Banks issue Eurodollar CDs to fund international lending and to raise funds to transfer to their home head offices where they can be used for domestic lending. Large U.S. banks continually compare the effective costs of raising funds in the United States and in the Eurodollar markets, and they substitute domestic CDs for Eurodollar CDs when the effective cost is lower in the United States, and vice versa. (The effective cost is the interest paid adjusted for the costs of holding noninterest-bearing reserve requirements and paying deposit insurance.)[4]

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[3] Some banks issue CDs denominated in yen, Canadian dollars, and ECU in addition to dollars.

[4] Kreicher (1982) provides a thorough discussion of arbitrage between the U.S. and Euro CD markets.

TABLE 1
London Foreign Currency CDs Outstanding
(Billions of U.S. Dollars; Percentage of Total in Parentheses)

Year-End	Total	U.S. Banks	Japanese Banks	British Banks	Other Banks
1980	48.7	26.8(55.0%)	8.8(18.1%)	4.6(9.4%)	8.5(17.5%)
1981	76.1	43.8(57.5%)	11.9(15.7%)	6.6(8.7%)	13.8(18.1%)
1982	92.6	50.3(54.4%)	19.0(20.5%)	9.3(10.0%)	14.0(15.1%)
1983	99.8	46.0(46.0%)	29.2(29.2%)	8.6(8.6%)	16.1(16.1%)
1984	94.7	34.0(35.9%)	33.4(35.3%)	7.6(8.1%)	19.7(20.8%)
1985	92.1	32.1(34.8%)	28.9(31.4%)	8.9(9.7%)	22.2(24.1%)
1986	114.8	27.8(24.2%)	45.4(39.6%)	12.5(10.9%)	29.1(25.3%)
1987	134.5	26.4(19.7%)	59.0(43.8%)	12.8(9.5%)	36.3(27.0%)
1988	140.7	23.1(16.4%)	67.4(47.9%)	9.9(7.0%)	40.3(28.6%)
1989	135.3	18.9(13.9%)	67.3(49.7%)	12.0(8.9%)	37.1(27.4%)
1990	136.9	13.4(9.8%)	58.2(42.5%)	14.4(10.5%)	50.9(37.2%)
1991*	116.3	13.0(11.2%)	36.8(31.6%)	15.5(13.3%)	51.0(43.9%)

* For September 1991.
Note: Starting in 1986 the data includes promissory notes, bills and other short-term paper, which were previously included within the UK monetary sector. In December 1985 this additional amount was 5.3 percent of the total (the sum of CDs and other short-term instruments).
Source: Bank of England, *Quarterly Bulletin,* various issues.

YANKEE CDS

Yankee CDs are negotiable CDs issued by the U.S. branches of foreign banks. The major issuers of Yankee CDs are the New York branches of the well-known international banks of Japan, Canada, England, and Western Europe, which use these funds to lend to their corporate customers in the United States.

Yankee CDs were first issued in the early 1970s. At first Yankee CDs paid a considerably higher yield than domestic CDs. This may have been because foreign banks were not well known and investors had difficulty assessing the credit quality of these banks because of different accounting rules and less available information. More recently, investors' perceptions of foreign banks have improved, and the premium paid by some foreign banks on their Yankee CDs has declined. The effect of the early difference in yields on the cost of raising funds was partially offset by the exemption of foreign banks from Federal Reserve

reserve requirements, which lasted until the International Banking Act of 1978. This exemption probably helped considerably to establish the market in Yankee CDs.

The Yankee CD market grew steadily from the early 1970s to a level of about $35 billion in the early 1980s. The market grew slowly over the rest of the 1980s and totaled $44 billion at the end of 1990. Beginning in 1991, however, Yankee CDs grew rapidly so that by September 1992, Yankee CDs outstanding amounted to $112 billion.

Most of the rapid growth in Yankee CDs in 1991 and 1992 resulted from the December 1990 elimination of reserve requirements on nonpersonal time deposits (time deposits received from those other than individuals or sole proprietorships) with maturities of less than 18 months. Prior to this action, foreign banks wishing to lend dollars to U.S. borrowers faced a 3 percent Federal Reserve reserve requirement when funding these loans with Yankee CDs. Foreign banks could avoid the reserve requirement by booking loans to U.S. borrowers at their offshore branches and funding the loans by issuing CDs in the Euro market. (U.S. banks, however, were prevented by Federal Reserve regulations from taking advantage of this reserve requirement loophole.) Therefore borrowing in the Euro market was encouraged. The December 1990 elimination of the reserve requirement erased the cost advantage the Euro market offered foreign banks and encouraged these banks to issue Yankee CDs.[5]

THRIFT CDS

Only the largest savings and loans are able to issue large negotiable CDs for sale in the national CD market. At the beginning of 1990, outstanding negotiable thrift CDs with original maturities of three months or less amounted to $11 billion.[6] The thrift industry's use of negotiable CDs declined as a result of the market's growing perception of the riskiness of thrifts and the continuing shrinkage of the industry resulting from failures and reorganizations. As of September 1992, outstanding negotiable thrift CDs with original maturities of three months or less amounted to $3.4 billion.

RISK AND RETURN

Because negotiable CDs are issued in denominations well above the $100,000 limit for deposit insurance coverage, investors face the risk that they may not

[5] See McCauley and Seth (1992) for a detailed explanation of this reserve requirement loophole and how it affected foreign bank lending in the United States.

[6] The only negotiable CD data S&Ls report are for those negotiable CDs with maturities of three months or less. This data first became publicly available in 1990.

receive full payment at maturity. The rate investors demand on a bank's negotiable CDs increases as the perceived riskiness of the bank increases.[7] This is often referred to as a credit risk premium.

Large CDs yield a premium over Treasury bills of comparable maturity. This is commonly attributed to three factors. First, as already mentioned, unlike investors in Treasury bills, investors in large CDs are subject to credit risk. Second, although the secondary market in large CDs is well developed, it does not possess the depth of the market in Treasury securities. Investors may demand a slightly higher yield to compensate for this smaller liquidity of CDs. Third, interest on Treasury bills is exempt from state and local income taxes. Consequently, many investors have to earn a higher before-tax yield on CDs than on Treasury securities to get the same after-tax yield. As interest rates rise, the tax exemption advantage of Treasury bills increases so that the premium of CDs over Treasury bills also tends to increase.

As shown by Figure 2, there have been several periods when the spread between three-month CD rates and three-month Treasury bill rates has grown large. The highest spread was about 470 basis points in 1974, due in part to the failure of two large banks (West Germany's Bankhaus Herstatt in June 1974 and Franklin National Bank in October 1974) and to the high interest rates prevailing at the time. The spread was also large in other periods of high interest rates, such as 1969 and 1980-81. Concern over default risk in the summer and fall of 1982 led to a rise in the spread to 275 basis points in September 1982 in spite of falling interest rates. Much of the increased spread can be attributed to the failure of Penn Square Bank in Oklahoma in July 1982 and the subsequent problems at some large banks that were involved with Penn Square, especially Chase Manhattan Bank and Continental Illinois National Bank & Trust Co. Another factor was the disclosure by some large U.S. banks in August 1982 of problems related to their loans to lesser-developed countries. The default risk premium rose again in the late 1980s following the stock market crash of October 1987.

RATINGS

Investors can use rating services to help determine the risk involved in buying a particular bank's CD. There are several rating services, including Standard & Poor's Corporation; Duff & Phelps, Inc.;[8] Moody's Investor Service, Inc.; Thomson Bankwatch, Inc.;[9<] IBCA, Ltd.; and Fitch Investor's Service, Inc.

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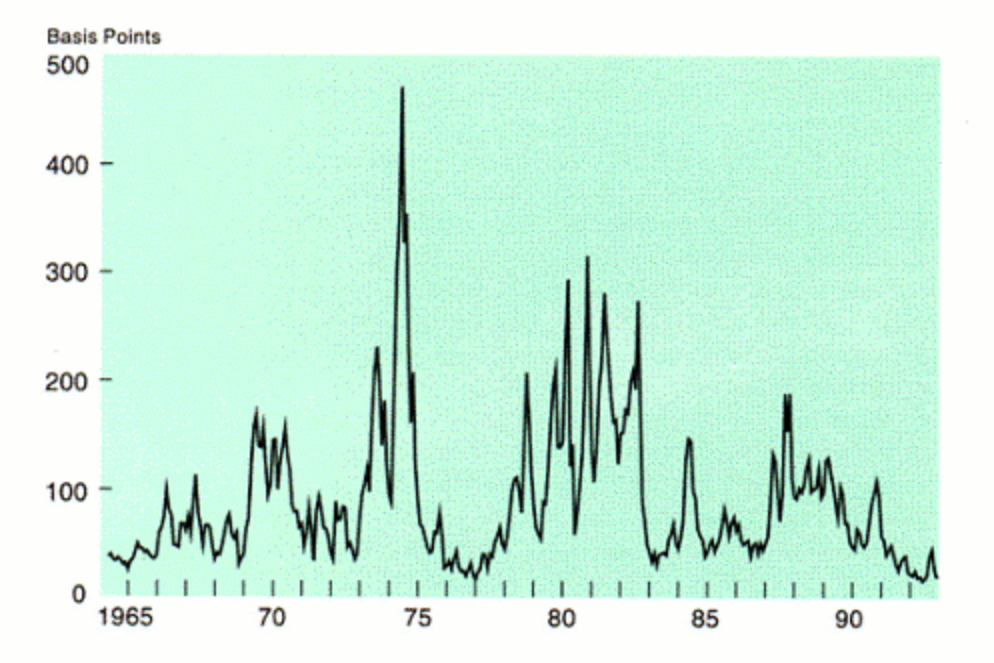
[7] Hannan and Hanweck (1988) give evidence that the market exacts a price for bank risk taking (i.e., market rates are higher for banks that are closer to insolvency). See Gilbert (1990) for a list of other empirical studies on market discipline of banks.

[8] Duff & Phelps rating service and McCarthy, Crisanti & Maffei merged in early 1991.

[9] The Bankwatch rating service was purchased by The Thomson Corporation in March 1989 from the investment firm Keefe, Bruyette & Woods.

FIGURE 2

Yield Spread Between Three-Month CDs and Treasury Bills



A CD rating is based on the rating agency's assessment of the ability of the issuer to redeem the CDs at maturity relative to other issuers. The agencies consider a number of factors, including the bank's liquidity, its interest rate risk, its competitive position in its operating environment, its profitability, its asset quality, the strength of its management, and the general economy.

PRIMARY MARKET

Each day, banks actively issuing large CDs post a set of rates for the most popular maturities—1, 2, 3, 6, and 12 months—at which they are willing to issue CDs. A bank's posted rates are dependent on the rates it can earn investing the funds in loans or investments. When a bank is not interested in raising funds, it will post below-market rates.

A bank tries to sell as many CDs as possible directly to investors. Because banks have limited capability to sell all their CDs directly to investors, however, they often sell some of their CDs to dealers who resell them to investors. In general, smaller banks and foreign banks make the greatest use of dealers when

selling their CDs. Banks also frequently sell to dealers CDs that are hard to sell directly to investors, such as longer-term CDs and variable-rate CDs.

In a typical transaction in the primary domestic CD market a large U.S. money center bank located in New York City issues a CD to a large domestic investor also headquartered in New York City. After the investor and the bank have agreed on the rate, maturity, and amount of the CD, the issuing bank delivers the certificate to the investor's custodian bank. After the custodian has verified the certificate, it debits the investor's account and makes payment to the issuing bank using the Federal Reserve's wire transfer network (Fedwire) to transfer federal funds from its reserve account at the Fed to the issuing bank's reserve account. Issuing banks require payment in federal funds because federal funds are immediately available for use. At maturity the CD is redeemed by presenting the certificate to the issuing bank followed by a Fedwire payment from the issuing bank to the investor's custodian bank. Large out-of-town banks that are active in the national CD market generally issue and redeem through a correspondent bank in New York City. Yankee and thrift CDs have similar mechanics.

The mechanics of a transaction in the Eurodollar CD market are different from those used for domestically issued CDs. The certificates remain in London at the investor's custodian bank while payment is made in New York. Funds are transferred from the investor's New York bank or its New York correspondent to the issuing bank's New York office or New York correspondent. Payment is made two business days after both parties agree to the terms of the sale. Normally payment is made through the Clearing House Interbank Payment System (CHIPS).[10]

Maturing certificates are repaid with interest in New York upon surrender of the certificate to the London issuing bank or London office of the issuer. Several clearing centers in London facilitate primary and secondary market transactions. The First Chicago Clearing Centre, set up by the First National Bank of Chicago, handles most Eurodollar CD transactions.

SECONDARY MARKET

The secondary market in large CDs makes it possible for investors to sell their CDs before they mature and to buy outstanding CDs as an alternative to buying new issues. Like the secondary market in other money market instruments, the market in large CDs is an over-the-counter market made up of dealers and brokers trading over the telephone.

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[10] CHIPS is an electronic payments system set up by the New York Clearing House Association. Payment on CHIPS is in clearinghouse funds which differ from payment in federal funds in that clearinghouse funds are not "immediately available good funds." Funds paid through CHIPS are not available until the end of the day.

Dealers make a market in large CDs by standing ready to buy and sell them for their own account. Dealers quote rates at which they are willing to buy (bid rate) and sell (ask rate) CDs. The quotes vary with the particular issuing bank and the maturity of the CD. All quotes move together, however, in response to changes in the overall money market, thereby keeping secondary market CD rates in line with rates on other money market instruments. The typical difference between the bid and ask rates for CDs is around 5 basis points. The most heavily traded CDs have the lowest bid-ask spreads.

Dealers trade with customers and with other dealers. Trades between dealers generally involve only top-quality CDs with remaining maturities of six months or less. The typical size of a CD transaction, called a round lot, varies from $5 million to $10 million. Trades between dealers and customers tend to have somewhat lower sizes than trades between dealers.

The daily average dealer positions for all large dealers peaked in 1985 at about $11 billion and fell to just $3.2 billion at the end of 1992. The amount of dealer positions tends to move with the amount of trading done by dealers, indicating that dealer trading of CDs has diminished since the mid-1980s. The decline can be explained by two factors. First, large banks began placing more and more negotiable CDs directly with investors without the aid of dealers. Second, banks issued a smaller dollar volume of CDs.

Brokers intermediate in transactions by bringing together buyers and sellers for a fee. They do not hold an inventory of CDs. Brokers are often used by dealers to do trades with other dealers because of the anonymity they provide.

The secondary market in domestically issued CDs is predominantly located in New York City, where most of the large money center banks and dealers are located. A small proportion of trading takes place in Chicago, San Francisco, and Los Angeles. Eurodollar CDs are traded in both London and New York City.

The mechanics of secondary market transactions are similar to those for primary market transactions. The certificates have to be physically transported between the participants or, more likely, their custodian banks. The settlement date on secondary market transactions in domestic, Yankee and thrift CDs varies depending on the time of trade. Trades executed in the morning are usually settled the same day (cash settlement), whereas trades later in the day are settled the next business day (regular delivery). Trades between dealers are usually settled the next business day regardless of the time of trade. Secondary market trades in Eurodollar CDs are generally made for settlement two business days forward (skip-day settlement). Payments for trades in domestic, Yankee and thrift CDs are made in federal funds through the dealers' clearing banks whereas payments for Eurodollar CDs are made in clearinghouse funds.

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The information in this chapter was last updated in 1993. Since the money market evolves very rapidly, recent developments may have superseded some of the content of this chapter.

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Chapter 5
EURODOLLARS

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THE NATURE OF THE EURODOLLAR

Eurodollars are bank deposit liabilities denominated in U.S. dollars but not subject to U.S. banking regulations. For the most part, banks offering Eurodollar deposits are located outside the United States. However, since late 1981 non-U.S. residents have been able to conduct business free of U.S. banking regulations at International Banking Facilities (IBFs) in the United States.[1] Eurodollar deposits may be owned by individuals, corporations, or governments from anywhere in the world, with the exception that only non-U.S. residents can hold deposits at IBFs.

Originally, dollar-denominated deposits not subject to U.S. banking regulations were held almost exclusively in Europe; hence, the name Eurodollars. Most such deposits are still held in Europe, but they also are held at U.S. IBFs and in such places as the Bahamas, Bahrain, Canada, the Cayman Islands, Hong Kong, Japan, the Netherlands Antilles, Panama, and Singapore. Regardless of where they are held, such deposits are referred to as Eurodollars.[2]

Banks in the Eurodollar market, including U.S. IBFs, compete with banks in the United States to attract dollar-denominated funds. Since the Eurodollar market is relatively free of regulation, banks in the Eurodollar market can operate on narrower margins or spreads between dollar borrowing and lending rates than can banks in the United States. This gives Eurodollar deposits an advantage relative to deposits issued by banks operating under U.S. regulations. In short, the Eurodollar market has grown up largely as a means of avoiding the regulatory costs involved in dollar-denominated financial intermediation.

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[1] Dollar-denominated deposits at a U.S. IBF or a bank located outside the United States are Eurodollars, even if the IBF or the bank is affiliated with a bank whose home office is a non-IBF U.S. bank. See Terrell and Mills (1983), Key (1982) and Lichtenstein (1982) for discussions of IBFs.

[2] See Ashby (1978) for a historical discussion of Europe's declining share of the global Eurocurrency market.

THE SIZE OF THE EURODOLLAR MARKET

Eurodollar volume is measured as the dollar-denominated deposit liabilities of banks located outside the United States. For example, the Bank for International Settlements (BIS) defines and measures Eurodollars as dollars that have "been acquired by a bank outside the United States and used directly or after conversion into another currency for lending to a nonbank customer, perhaps after one or more redeposits from one bank to another."[3]

The sum of all dollar-denominated liabilities of banks outside the United States measures the gross size of the Eurodollar market. For some purposes, it is useful to net some interbank deposits out of the gross to arrive at an estimate of Eurodollar deposits held by original suppliers to the Eurodollar market. Roughly speaking, to construct the net size measure, deposits owned by banks in the Eurodollar market are netted out. But deposits owned by banks located outside of the Eurodollar market area are not netted out because these banks are considered to be original suppliers of funds to the Eurodollar market. For still other purposes, such as comparing the volume of deposits created in the Eurodollar market with the U.S. monetary aggregates, it is useful to further net out all bank-owned Eurodollar deposits. Doing so leaves only the nonbank portion of the net size measure, or what might be called the net-net size of the Eurodollar market.

The most readily accessible estimates of the size of the Eurodollar market were compiled by Morgan Guaranty Trust Company of New York and reported in its monthly bank letter, World Financial Markets.[4] Morgan's estimates included data compiled by the BIS. However, Morgan's estimates were somewhat more comprehensive. Morgan reported estimates of the size of the entire Eurocurrency market based roughly on all foreign-currency liabilities of banks in major European countries, nine other market areas, and U.S. IBFs. Morgan stopped publishing its Euromarket data in 1988.

As of March 1988 Morgan estimated the gross size of the Eurocurrency market at $4,561 billion; the net size was put at $2,587 billion.[5] Morgan also reported that Eurodollars made up 67 percent of gross Eurocurrency liabilities, putting the gross size of the Eurodollar market at $3,056 billion.[6] No net size

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[3] Bank for International Settlements 1964, p. 127. In principle, today the definition includes acquisitions by IBFs.

[4] See Morgan Guaranty (January 1979, pp. 9-13) for a discussion of Morgan's method of measuring the size of the Eurodollar market. Other informative discussions of issues involved in measuring the Eurodollar market's size are found in Dufey and Giddy (1978, pp. 21-34) and Mayer (1976).

[5] Morgan Guaranty, November 1988, p. 13. Most of the growth of the Eurocurrency market has occurred in the last two decades. Dufey and Giddy (1978, p. 22) reports Morgan's earliest estimate of the gross size of the Eurocurrency market as only $20 billion in 1964. See Dufey and Giddy (1978, Chap. III) for a discussion of the growth of the Eurocurrency market. On the net size, see Morgan Guaranty (November 1988, p. 13).

[6] Ibid.

for the Eurodollar market was given. However, 67 percent of the net size of the Eurocurrency market yields $1,733 billion as an approximate measure of the net size of the Eurodollar market.

M2 is the narrowest U.S. monetary aggregate that includes some Eurodollar deposits. M2 includes overnight Eurodollar deposits held by U.S. residents other than depository institutions and money market funds at branches of U.S. banks worldwide. As of May 1991, M2 measured $3,396 billion; its Eurodollar component was $17.8 billion.[7] This comparison shows clearly that Eurodollar deposits account for a relatively small portion of monetary assets held by U.S. residents.

INCENTIVES FOR DEVELOPMENT OF THE EURODOLLAR MARKET[8]

By accepting dollar-denominated deposits and making dollar-denominated loans outside the United States and at U.S. IBFs, banks avoid some U.S. banking regulations. For example, IBFs and banks located outside the United States do not have to hold noninterest-bearing required reserves against their dollar-denominated deposits. Recently, reserve requirements have been eliminated on all time deposits in the United States and have been reduced from 12 to 10 percent on transactions deposits. However, U.S. bank regulations have been strengthened as a result of the banking problems encountered in the 1980s. Regulatory initiatives such as stricter capital standards, higher deposit insurance premiums, and more intense supervisory scrutiny have raised the cost of depository intermediation in the United States.

Eurodollar banks hold balances with banks in the United States for clearing purposes only and otherwise avoid reserve requirements. Moreover, there is no deposit insurance assessment on Eurodollars. Although stricter capital standards also have been imposed internationally, the regulatory cost of depository intermediation in the United States remains higher than in the Eurodollar market.

In most Eurodollar financial centers, entry into Eurodollar banking is virtually free of regulatory impediments, so banks intending to do Eurodollar business can easily set up in locations where tax rates are low. For example, Eurodollar deposits and loans negotiated in London or elsewhere often are booked in locations such as Nassau and the Cayman Islands to obtain more favorable tax treatment. In addition, various states in the United States have amended their tax codes to grant IBFs relief from local taxes.

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[7] Board of Governors of the Federal Reserve System 1991, pp. 1 and 7. At present, Eurodollars held by non-U.S. residents are not included in any of the U.S. monetary aggregates. As improved data sources become available, the possible inclusion of Eurodollars held by non-U.S. residents other than banks and official institutions could be reviewed. See Board of Governors of the Federal Reserve System (1980, p. 98).

[8] See Dufey and Giddy (1978, pp. 110-12) for a historical discussion of the conditions that made large-scale growth of the Eurodollar market possible.

Foreign monetary authorities generally are reluctant to regulate Eurodollar business because to do so would drive the business away, denying the host country income, tax revenue, and jobs. Even if the U.S. monetary authorities could induce a group of foreign countries to participate in a plan to regulate their Euromarkets, such a plan would be ineffective unless every country agreed not to host unregulated Eurodollar business. In practice, competition for such business has been fierce, so even if a consensus should develop in the United States to regulate Eurodollar business, it would be extremely difficult to impose regulations on the entire Eurodollar market.

INSTRUMENTS OF THE EURODOLLAR MARKET[9]

The overwhelming majority of money in the Eurodollar market is held in fixed-rate time deposits (TDs). The maturities range from overnight to several years, although most are from one week to six months. Eurodollar time deposits are intrinsically different from dollar deposits held at banks in the United States only in that the former are liabilities of IBFs or of banks located outside the United States. The bulk of Eurodollar TDs are interbank liabilities. They pay a fixed, competitively determined rate of return.[10]

Another important Eurodollar instrument is the Eurodollar certificate of deposit (CD). Essentially, a Eurodollar CD is a negotiable receipt for a dollar deposit at a bank located outside the United States or in a U.S. IBF. From their introduction in 1966, the volume of Eurodollar CDs outstanding reached roughly $50 billion at the beginning of 1980.[11] By late 1990, Eurodollar CD volume was around $130 billion. The 1990 elimination of the 3 percent reserve requirement on nonpersonal time deposits and CDs in the United States has made the Eurodollar CD market a bit less active. As of spring 1992, volume had fallen to around $116 billion.

Recently, fixed-rate, three-month Eurodollar CDs have yielded approximately 10 basis points below the three-month London Interbank Offered Rate (LIBOR).[12] LIBOR is the rate at which major international banks are willing to offer term Eurodollar deposits to each other. An active secondary market allows

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[9] Bank for International Settlements (1986, Chaps. 1 and 4), Dobbs-Higginson (1980, pp. 55-61), Dufey and Giddy (1978, pp. 228-32), and Stigum (1990, Chaps. 7, 18, 20, and 22) contain informative discussions of Eurodollar instruments.

[10] See Stigum (1990, pp. 890-93) and Dufey and Giddy (1978, p. 227) for discussions of the tiering of Eurodollar deposit rates according to the perceived creditworthiness of issuing banks. *The Banker* (1987) has a discussion of tiering in the Euro-CD market.

[11] Bank of England, Financial Statistics Division, International Banking Group. This data includes all London foreign currency CDs. Almost all Euro CDs are issued in London, however, and almost all of these are denominated in dollars. Early descriptions of the London dollar CD market are found in Credit Suisse (1980) and "The London Dollar CD" (1973).

[12] This spread was calculated using data in Salomon Brothers (1990) and the DRI database.

investors to sell Eurodollar CDs before the deposits mature. Secondary market makers' spreads for short-term fixed-rate CDs have been 1 to 3 basis points for European bank dollar CDs and around 5 basis points for Japanese bank dollar CDs.[13]

Eurodollar CDs are issued by banks to "tap" the market for funds and are commonly issued in denominations of from $250,000 to $5 million. Some Eurodollar CDs, called Tranche CDs, are issued in very large denominations but marketed in several portions in order to satisfy investors with preferences for smaller instruments. The latter are issued in aggregate amounts of $10 million to $30 million and are offered by banks to individual investors in $10,000 certificates, with each certificate having the same interest rate, issue date, interest payment dates, and maturity.

In the late 1970s Eurodollar floating-rate CDs (FRCDs) and Eurodollar floating-rate notes (FRNs) came into use as means of protecting both borrower and lender against interest rate risk. By making their coupon payments float with market interest rates, these "floaters" stabilize the principal value of the paper. The market for FRCDs is no longer active. The volume of FRNs outstanding fell from $125 in 1986 to $116 in 1990.[14]

Eurodollar FRNs have been issued in maturities from 4 to 20 years, with the majority of issues concentrated in the five- to seven-year range. Eurodollar FRNs tend to be seen as an alternative to straight fixed-interest bonds, but they can in principle be used like FRCDs. Eurodollar FRNs have been issued primarily by banks and sovereign governments. FRNs issued by governments are not Eurodollars proper since they are not bank liabilities. Strictly speaking, they should be referred to as Eurodollar instruments together with the NIFs and Euro commercial paper discussed below.

Eurodollar FRCDs and FRNs are both negotiable bearer paper. The coupon or interest rate on these instruments is reset relative to the corresponding LIBOR every three or six months. The rate is set below LIBOR for sovereign borrowers and above for U.S. banks. Yields on Eurodollar FRNs range from 1/8 percent under the London Interbank Bid Rate (LIBID) up to LIBOR.[15] To determine LIBOR for Eurodollar FRNs, "the issuer chooses an agent bank who in turn polls three or four Reference Banks—generally, the London offices of major international banks. Rates are those prevailing at 11:00 a.m. London time two business days prior to the commencement of the next coupon period."[16]

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[13] Information on interest rate spreads in the Eurodollar market was provided by Robert Smith and Jean Walshe of First Boston Corporation.

[14] See Bank for International Settlements, *International Banking and Financial Market Developments.*

[15] LIBID, the rate at which major international banks are willing to take deposits from one another, is normally 1/8 percent below LIBOR.

[16] Salomon Brothers 1980, p. 7.

A secondary market exists in FRNs. The spread quoted on FRNs in the secondary market is generally 10 cents per $100 face value for the liquid sovereign issues. Other spreads are quoted on an indicative basis and are somewhat higher.

Note Issuance Facilities (NIFs) became a significant Eurodollar instrument in the mid-1980s.[17] A NIF is a medium-term, usually five- to seven-year arrangement between a borrower and an underwriting bank under which the borrower can issue short-term, usually three- to six-month, paper known as Euro-notes in its own name. Under such an arrangement, the underwriting bank is committed either to purchase any notes the borrower cannot sell or to provide standby credit at a predetermined spread relative to some reference rate such as LIBOR. Underwriting fees are paid on the full amount of the line of credit, regardless of the amount currently drawn. The fee is 5 basis points for top borrowers and ranges up to 15 basis points for worse credit risks. The notes are issued with face amounts of $100,000, $500,000, or more.

Well-regarded borrowers can issue Euro-notes at around LIBID. Top borrowers can issue at yields 1/16 or 1/8 percentage point below LIBID. Euro-notes are comparable investments to Eurodollar CDs.

When the market initially matured around 1985, nonbank corporate borrowers accounted for roughly 60 percent of NIFs arranged. Most borrowers were from countries in the Organisation for Economic Co-operation and Development. As of April 1986, about $75 billion of NIFs had been arranged, with only an estimated $10 to $15 billion having been drawn. Most paper was placed with smaller, non-underwriter banks. In 1985, about one-third or more of placements may have been with nonbank investors, including money market funds, corporations, insurance companies, wealthy individuals, and central banks.

Since mid-1984, facilities similar to NIFs have been arranged without underwriting commitments. In the second half of 1985, new non-underwritten agreements equaled new NIFs arranged. Non-underwritten agreements have become much like U.S. commercial paper programs: note issuance has been separated from the standby arrangement, notes are issued in shorter odd maturities, and notes can be marketed quickly. Under such an arrangement, a bank is simply a marketing agent. Euro-notes issued under such conditions are known as Euro commercial paper. The volume of newly arranged NIFs declined from $40 billion in 1985 to $4 billion in 1990, while Euro commercial paper outstanding rose from $17 billion in 1986 to $70 billion in 1990.[18] Recently strengthened risk-based capital requirements have, in part, induced the shift to Euro commercial paper because they have raised the regulatory cost associated with NIFs. Euro

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[17] Material on NIFs was taken from Bank for International Settlements (1986, Chap 1). Melnik and Plaut (1991) discuss NIFs and Euro commercial paper programs.

[18] See Organisation for Economic Co-operation and Development (1991, p. 77) and Bank for International Settlements, *International Banking and Financial Market Developments.*

commercial paper yields range from LIBID minus 25 basis points for top-rated sovereigns to LIBOR plus 30 for low-rated corporations.[19]

For most U.S. corporations, the U.S. commercial paper market probably remains a cheaper source of funds than Euro commercial paper. For some non-U.S. corporations, however, Euro commercial paper may be as cheap as U.S. commercial paper because of the premium that foreign issuers pay in the U.S. commercial paper market. Like the U.S. commercial paper market, the secondary market for Euro commercial paper is relatively underdeveloped. If a client needs to sell paper before maturity, he will almost always sell it to the dealer who sold him the paper initially. Any trading usually occurs in the first few days after the paper is issued. Trading is most frequent in the sovereign sector, which accounts for about 20 percent of Euro commercial paper outstanding.

INTEREST RATE RELATIONSHIPS BETWEEN EURODOLLAR DEPOSITS AND DEPOSITS AT BANKS IN THE UNITED STATES

Arbitrage keeps interest rates closely aligned between Eurodollar deposits and deposits with roughly comparable characteristics at banks located in the United States.[20] This is illustrated in Figures 1 and 2. Figure 1 compares yields on federal funds and overnight Eurodollar deposits. Figure 2 compares yields on Eurodollar CDs and CDs issued by banks located in the United States.

THE RELATIVE RISKINESS OF EURODOLLAR DEPOSITS AND DOLLAR DEPOSITS HELD IN THE UNITED STATES[21]

There are three basic sources of risk associated with holding Eurodollars. The first concerns the chance that authorities where a Eurodollar deposit is held may interfere in the movement or repatriation of the principal of the deposit or the interest paid on it. But this risk factor does not necessarily imply that Eurodollar deposits are riskier than dollar deposits held in the United States. Rather, the relative riskiness can depend on the deposit holder's residence. For U.S. residents, Eurodollars may appear riskier than domestic deposits because of the possibility that authorities in the foreign country where the deposit is located may interfere in the movement or repatriation of the interest or principal of the deposit. On

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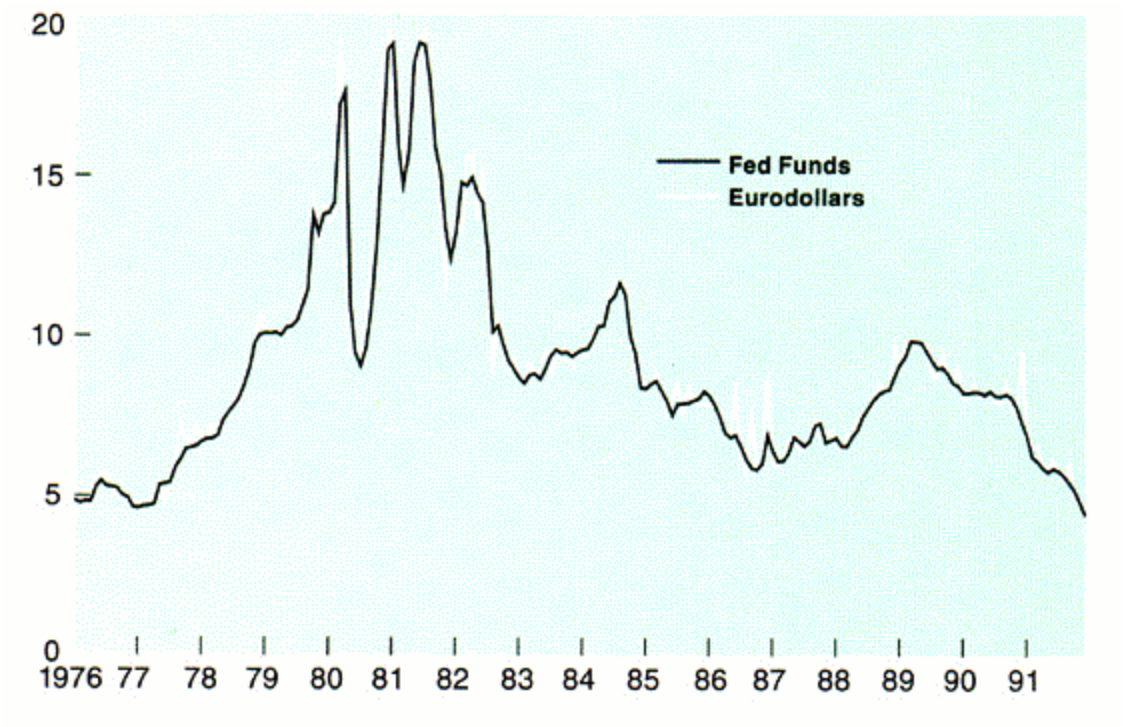
[19] Andersen 1990, p. 65.

[20] See Kreicher (1982) for a detailed discussion of Eurodollar arbitrage.

[21] See Dufey and Giddy (1978, pp. 187-90) and Tyson (1980) for more discussion of the riskiness of Eurodollars.

FIGURE 1

Yields on Federal Funds and Overnight Eurodollar Deposits

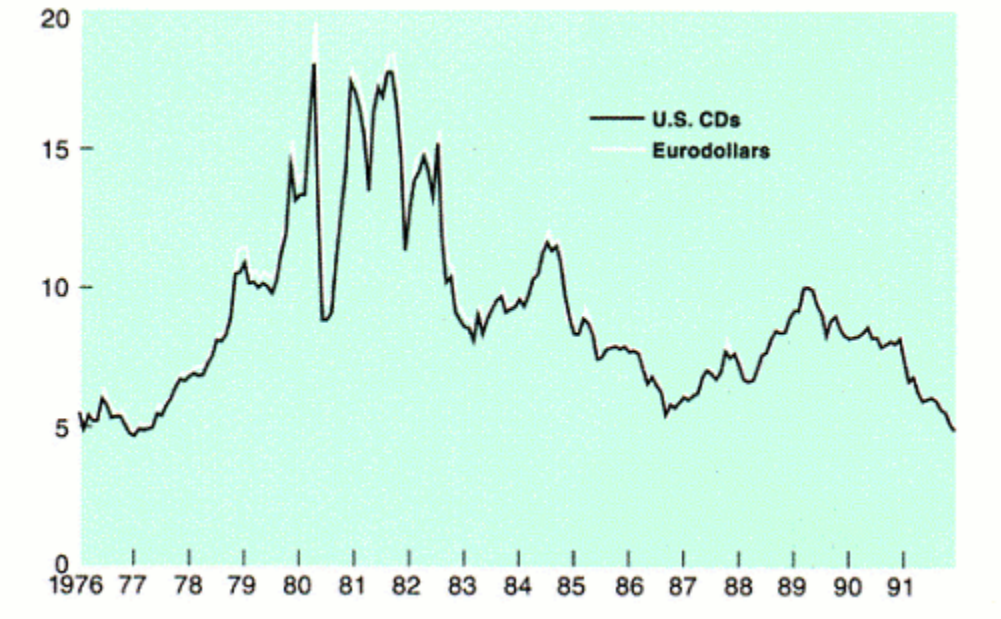


the other hand, some foreign residents may feel that the U.S. government is more likely to block their deposits than the British government. Consequently, they may perceive greater risk from potential U.S. government interference by holding dollar deposits in the United States than by holding Eurodollar deposits in London.

A second element of risk associated with Eurodollars concerns the potential for international jurisdictional disputes. For example, uncertainty surrounding interaction between United States and foreign legal systems compounds the difficulty in assessing the likelihood and timing of payment on Eurodollar deposits in the event of an issuing bank's failure. A third type of risk associated with holding Eurodollars concerns the soundness of deposits at banking offices located in foreign countries relative to banking offices located in the United States. Eurodollars can be riskier than deposits held in the United States because deposits held in the United States can carry explicit deposit insurance of some kind while Eurodollar deposits generally do not. Also, in the event of a financial crisis, banks located in the United States are more likely to be supported by the Federal Reserve System, whereas neither the support of the Federal Reserve nor that of foreign central banks for Eurodollar banking activities is certain.

FIGURE 2

Yields on U.S. and Eurodollar Three-Month CDs



Compounding the three basic risk factors identified above is the greater cost of evaluating foreign investments than domestic investments. Acquiring information on the soundness of foreign banks is generally more costly than assessing the soundness of more well-known domestic banks. This means that for a given level of expenditure on research, investors must generally accept more ignorance about the soundness of a foreign bank than a domestic bank. If a depositor resides in the United States, a given expenditure on research generally yields more information about the safety of deposits located in the United States than in the Eurodollar market. But if a depositor resides outside the United States, the reverse may be true. Having said this, it must be pointed out that financial disclosure required by regulatory authorities abroad is generally not as great as in the United States.

Assessing the safety of Eurodollar deposits is made easier by the fact that many banks in the Eurodollar market are branches of and bear the same name as a bank whose home office is in the United States. For example, a London branch of a U.S. bank is an integral part of its corporate parent. In many cases, however, foreign offices bearing the name of a U.S. bank, usually in a slightly altered form, have been set up as subsidiaries rather than branches. Under most legal systems, a branch cannot fail unless its head office fails, but a subsidiary can fail even if its

parent institution remains in business. Technically, even if a foreign office bears the name of a U.S. bank in some form, the parent institution may not be legally bound to stand fully behind the obligations of its foreign office. This suggests that a foreign office named after a parent U.S. bank may not be as sound as its namesake, although the parent bank unquestionably has great incentive to aid the foreign office in meeting its obligations in order to preserve the bank's good name.[22]

On the whole, it is difficult to assess the relative riskiness of Eurodollar deposits and dollar deposits held in the United States. Some factors affecting relative risk can be identified, but their importance is difficult to measure. What is more, perceived relative riskiness depends on the residence of the depositor.

SUMMARY

From the depositor's point of view, Eurodollars including those at U.S. IBFs are close substitutes for dollar deposits at non-IBF banks located in the United States. Eurodollar deposits are attractive because they are free of most regulatory burdens imposed by U.S. authorities. In fact, the tremendous growth of the Eurodollar market in the last two decades has largely resulted from efforts to move dollar financial intermediation outside the regulatory jurisdiction of the United States.

Host countries have competed eagerly for Eurodollar business by promising relatively few regulations, low taxes, and other incentives. Even the United States, through IBFs introduced in 1981, is now competing for Eurodollar business. Financial intermediation in U.S. dollars will continue to move abroad or to IBFs as long as incentives exist for it to do so.

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[22] See Mendelsohn (1984), Stoakes (1985), and *American Banker* (1987) for discussions of a case where a large U.S. bank refused to make good on the deposits of its Philippine branch after they were frozen by Philippine exchange controls. Also see Dufey and Giddy (1984) on this issue.

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The information in this chapter was last updated in 1993. Since the money market evolves very rapidly, recent developments may have superseded some of the content of this chapter.

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Chapter 6
REPURCHASE AND REVERSE REPURCHASE AGREEMENTS

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INTRODUCTION

The terms repurchase agreement (repo or RP) and reverse repurchase agreement refer to a type of transaction in which a money market participant acquires immediately available funds by selling securities and simultaneously agreeing to repurchase the same or similar securities after a specified time at a given price, which typically includes interest at an agreed-upon rate. Such a transaction is called a repo when viewed from the perspective of the supplier of the securities (the party acquiring funds) and a reverse repo or matched sale-purchase agreement when described from the point of view of the supplier of funds.

In general, whether a given agreement is termed a repo or a reverse depends largely on which party initiated the transaction, but there are a few exceptions. RP transactions between a dealer and a retail customer or between a dealer and the Federal Reserve, for example, are usually described from the dealer's perspective. Thus, a retail investor's purchase of securities and commitment to resell to a dealer is termed a repo because the dealer has sold the securities under an agreement to repurchase. Similarly, when the Federal Reserve temporarily supplies funds to the market by buying securities from dealers with a commitment to resell, the transaction is called a repo; the converse transaction, in which specific securities are sold from the System's portfolio for immediate delivery and simultaneously repurchased for settlement on the desired date, is called a matched sale-purchase agreement (MSP). (When the Fed is involved, the term "reverse repo" generally is not used, although MSPs produce the reverse effect on reserves as RPs.)

In many respects, repos are hybrid transactions that combine features of both secured loans and outright purchase and sale transactions but do not fit cleanly into either classification. The use of margin or haircuts in valuing repo securities, the right of repo borrowers to substitute collateral in term agreements, and the use of mark-to-market provisions are examples of repo features that typically are characteristics of secured lending arrangements but are rarely found in outright purchase and sale transactions. The repo buyer's right to trade the securities during

the term of the agreement, by contrast, represents a transfer of ownership that typically does not occur in collateralized lending arrangements.

CHARACTERISTICS OF RP AGREEMENTS

Maturities RP agreements usually are arranged with short terms to maturity—overnight or a few days. Longer-term repos are arranged for standard maturities of one, two, and three weeks and one, two, three, and sometimes six months. Other fixed-term, multi-day contracts are negotiated occasionally and repos also may be arranged on an "open" or continuing basis. Continuing contracts resemble a series of overnight repos; they are renewed each day with the repo rate or the amount of funds invested adjusted to reflect prevailing market conditions. If, for example, the market value of the securities being held as collateral were to fall below an agreed-upon level, the borrower would be asked to return funds or provide additional securities. Continuing contracts usually may be terminated on demand by either party.

Principal Amounts RP transactions are usually arranged in large dollar amounts. Overnight contracts and term repos with maturities of a week or less are often arranged in amounts of $25 million or more, and blocks of $10 million are common for longer-maturity term agreements. Although a few repos are negotiated for amounts under $100,000, the smallest customary amount for transactions with securities dealers is $1 million.

Yields The lender or buyer in an RP agreement is entitled to receive compensation for use of the funds provided to its counterparty. In some agreements, this is accomplished by setting the negotiated repurchase price above the initial sale price, with the difference between the two representing the amount of interest owed to the lender. It is more typical, however, for the sale and repurchase prices to be the same, with an agreed-upon rate of interest to be paid separately by the borrower on the settlement date. It should be noted, however, that the provider of funds in a standard repo transaction earns only the agreed-upon rate of return. If a coupon payment is made on the underlying securities during the term of the agreement, it is common practice for the repo borrower to receive the payment.

Determinants of RP Rates The interest rate paid on RP funds, the repo rate of return, is negotiated by the repo counterparties and is set independently of the coupon rate or rates on the underlying securities. In addition to factors related to the terms and conditions of individual repo arrangements, repo interest rates are influenced by overall money market conditions, the competitive rates paid for comparable funds in related markets, and the availability of eligible collateral.

Repurchase agreements are close substitutes for federal funds borrowings, so the activities of institutions that have direct access to both markets should keep the rates on RP and federal funds transactions in close relationship to each other. In addition to commercial banks, these institutions are savings and loan associations, mutual savings banks, credit unions, and federally related credit agencies such as the Federal Home Loan Banks. For example, when the demand for reserves is high relative to the existing supply, depository institutions bid more aggressively for federal funds, thereby putting upward pressure on the federal funds rate. As the funds rate rises, some institutions will turn to the RP market to raise funds, which also puts upward pressure on the RP rate. Both rates will continue to rise until the demand and supply for reserves in the banking system are again in balance.

The overnight federal funds rate generally exceeds the overnight RP rate, reflecting the compensation investors require for lending unsecured in the federal funds market rather than investing in a collateralized RP agreement. The spread between the federal funds rate and the RP rate has varied substantially over time, generally widening during periods of rapid increases in the funds rate and narrowing as the funds rate has stabilized or declined, regardless of the overall level of rates. Movements in the spread also tend to reflect changes in the availability of eligible collateral and in the perceived riskiness of RP investments. A decline in the volume of securities held in dealers' inventories, for example, would typically be associated with a widening in the spread, as the reduced demand for RP financing by dealers would tend to exert downward pressure on the RP rate relative to the funds rate. By contrast, the RP rate has tended to rise relative to the federal funds rate when net borrowing in the RP market by dealers has increased sharply. At times, the additional financing burden has contributed to chronically tight and sometimes negative spreads between federal funds and RP rates.[1] The spread also has narrowed considerably when the security of the RP agreement itself has been called into question, most often as a result of failures of government securities dealers.

Calculation of RP Returns RP rates are quoted on an investment basis with a bank discount annualization factor.

The dollar amount of interest earned on funds invested in an RP is determined as follows:

Interest earned = funds invested x RP rate x (number of days/360).

For example, a $1 million overnight RP investment at a 5.75 percent rate would yield an interest return of $159.72:

$1,000,000 x .0575 x (1/360) = $159.72.

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[1] The spread was negative over much of 1991 and 1992, perhaps reflecting the inability or unwillingness of banks to engage in arbitrage transactions to eliminate the differential.

If the funds were invested in a ten-day term agreement at the same rate of 5.75 percent, the investor's interest earnings would look as follows:

$1,000,000 x .0575 x (10/360) = $1,597.22.

As a final example, suppose that the investor had entered into a continuing contract with the borrower at an initial rate of 5.75 percent, but withdrew from the arrangement after a period of five days. Assuming RP rates changed as indicated below, the investor's return over the period would be $802.22:

Day	RP Rate	Calculation	Interest
First day	5.75	$1,000,000 x .0575 x (1/360) =	$159.72
Second day	5.80	$1,000,000 x .0580 x (1/360) =	$161.11
Third day	5.83	$1,000,000 x .0583 x (1/360) =	$161.94
Fourth day	5.78	$1,000,000 x .0578 x (1/360) =	$160.56
Fifth day	5.72	$1,000,000 x .0572 x (1/360) =	$158.89
Total interest earned:			$802.22

If the investor had entered into a five-day term agreement at the rate of 5.75 percent prevailing on the first day, he would have earned only $798.60 in interest. Thus, in this hypothetical example, the movement in rates worked to the investor's advantage.

Valuation of Collateral Although most repo transactions involve the exchange of U.S. Treasury and federal agency securities, including mortgage-backed pass-through securities, and other instruments with real or perceived low credit risk, the agreements themselves are not risk-free. RPs, especially longer-term contracts, entail both interest rate risk and credit risk, which must be taken into account when an RP contract is negotiated. Typically, the securities used as collateral are valued at the current market price, plus accrued interest calculated to the maturity date of the agreement when coupon-bearing issues are used, less a margin of overcollateralization or "haircut" for term agreements.

Taking Margin and Marking to Market Normally, the initial RP price is less than the market value of the underlying securities, which reduces the lender's exposure to market risk. Government securities dealers, for example, frequently take such a haircut on reverses arranged with nondealer customers to cover their exposure on the funds transferred.

Inasmuch as the size of the haircut should be adequate to guard against the potential loss from adverse price movements during the repo term, haircuts tend to be larger the greater the price volatility of the underlying securities with respect to a given change in interest rates. Hence, haircuts tend to increase as the term to maturity of the repo securities lengthens, and haircuts for discount

bonds typically exceed those of premium bonds. Haircuts also tend to increase with credit risk, so those taken on private money market instruments typically exceed those of comparable maturity Treasury securities.

Because both parties in a term repo arrangement are exposed to interest rate risk, it is a fairly common practice to have the collateral value of the underlying securities adjusted daily ("marked to market") to reflect changes in market prices and to maintain the agreed-upon margin. Accordingly, if the market value of the repo securities declines appreciably, the borrower may be asked to provide additional collateral. Then again, if the market value of the securities rises substantially, the lender may be required to return the excess collateral to the borrower.

Treatment of Accrued Interest Prior to the failure of Drysdale Government Securities in May 1982, it was common practice in the RP market to ignore the value of accrued interest in pricing RPs using coupon-bearing securities. This practice enabled Drysdale to acquire a substantial amount of "undervalued" securities, despite its limited capital base. Drysdale used the securities it had reversed in to make short sales to a third party for an amount that included the accrued interest. Using the surplus cash generated, Drysdale was able to raise working capital and to make interest payments to its other repo counterparties. The strategy worked adequately until May 17, 1982, when cumulative losses on Drysdale's interest rate bets caused it to be unable to pay the interest on securities it had borrowed.

This episode illustrated the risk to repo borrowers of not including accrued interest in the initial price of the repo security. Later that year, in response to the weaknesses exposed by the Drysdale affair, full accrual pricing, in which accrued interest is included in full in the initial purchase and resale prices, was adopted as standard market practice, largely at the impetus of the Federal Reserve Bank of New York.

LEGAL STATUS OF RP AGREEMENTS

The bankruptcy of Lombard-Wall, Inc. in August 1982, the result of the firm's inability to return funds it had obtained in overvalued long-term RPs, generated considerable uncertainty about the legal status of repos and the contractual rights of the counterparties when one of them files for protection under federal bankruptcy laws. Prior to Lombard-Wall's bankruptcy, repo market participants operated under the assumption that the purchaser of repo securities was entitled to liquidate them if the seller was unable to fulfill the terms of the agreement at settlement. The validity of this assumption was tested in the proceedings following Lombard-Wall's bankruptcy filing. Federal Bankruptcy Judge Edward J. Ryan initially froze all securities that Lombard-Wall had sold under repurchase agreements. After permitting a number of counterparties to sell off their

securities, he ruled in September 1982 that the RP agreements Lombard-Wall had negotiated with a particular bank were secured loans and, therefore, subject to the "automatic stay" provisions of the Bankruptcy Code, which block any efforts of a creditor to make collections or to enforce a lien against the property of a bankrupt estate. According to this interpretation, even if the lender had acquired actual title to the securities, the borrower would be deemed under the law to have an equitable interest in the securities. Although this last ruling dealt specifically with only one bank, it was viewed as a precedent.

At the urging of primary government securities dealers and some prompting by the Federal Reserve Bank of New York, Congress amended Title 11 of the U.S. Code to exempt certain repurchase agreements from the automatic stay provisions of the Bankruptcy Code when it enacted the Bankruptcy Amendments Act of 1984 in June of that year. Coverage is limited to overnight RPs and term agreements up to a year in Treasury and agency securities and selected money market instruments. The legislation does not resolve the question of whether an RP agreement is a secured lending arrangement or a purchase and sale transaction, but it enables lenders to liquidate any repo securities in their possession under either interpretation.

The legislation, however, left open the question of the rights of repo counterparties who are not in possession of the repo collateral at the time of a bankruptcy filing. This question was soon raised in 1985 with the failures of a few unregistered nonprimary government securities dealers, most notably E.S.M. Government Securities, Inc. and Bevill, Bresler, and Schulman Asset Management Corp. Investors dealing with these firms failed to take adequate steps to protect against custodial risk. Failure to establish appropriate safeguards resulted in sizable losses for a number of the repo counterparties of E.S.M. and Bevill, Bresler, and Schulman when the firms filed for bankruptcy in 1985. In some instances, investors reportedly were sold nonexistent securities, while in others, the same securities were "sold" under repo to a number of investors.

At issue in the bankruptcy proceedings was the question of whether the repo counterparties had a priority legal interest in the securities under the control of the bankruptcy trustee or whether they were general unsecured creditors of the bankrupt estate. This depended to a large extent on whether the repos in question were secured loans or purchases and sales. In reviewing the circumstances of the Bevill, Bresler, and Schulman case, the Bankruptcy Court ruled in October 1986 that because the basic custom in the market is to treat repo transactions as consummated sales and contracts to repurchase, the same characterization should be applied in the event of the default and subsequent bankruptcy of one party. Hence, the repo counterparties to Bevill, Bresler, and Schulman were judged to qualify as customers under the Securities Investor Protection Act and thus were entitled to preferred status in distribution of the firm's assets and up to $500,000 in SIPC insurance.

The Court made other important rulings under Article 8 of the Code, including the finding that a broker-dealer has "effective possession" of securities in the possession of its clearing bank that permits it to make deliveries to its customers, but that such possession is limited to only those securities held for the broker-dealer in a segregation account; the clearing bank retains a contractual lien in those securities remaining in the broker-dealer's general clearing account. (The distinction between a segregation account and general account is explained below.)

REPO CUSTODIAL ARRANGEMENTS

Usually, when an RP is arranged, the underlying securities are transferred against payment over the Federal Reserve's securities wire ("Fedwire"). At maturity, the RP collateral is returned over Fedwire against payment. Direct access to the Federal Reserve's securities and payments transfer systems is restricted, however, to depository institutions and selected special entities, including foreign central banks and federally sponsored agencies that are statutory fiscal principals. Consequently, transfers of repo securities usually are processed by means of Reserve Bank credits and debits to the securities and clearing accounts of depository institutions acting as clearing agents for their customers. Transfers of physical securities also typically involve clearing agents.

The transaction costs associated with the payment for and delivery of repo securities include some combination of securities clearance fees, wire-transfer charges for securities in book-entry form, custodial fees, and account-maintenance fees. The exact charges can vary considerably from case to case depending on the type of securities involved and the actual method of delivery. Fedwire charges for securities transfers are slightly higher, for example, for transfers of agency securities than for Treasury securities. In any case, the total transaction costs to process transfers of securities from the borrower to the lender are higher the greater the number of intermediate transactions. Although these costs are often inconsequential for longer-maturity transactions in large dollar amounts, they can add significantly to the overall costs of other transactions.

In order to avoid some of these costs and to increase the investor's net yield, dealers offer their repo counterparties a number of collateral arrangements that do not involve the actual delivery of collateral to the lender and concomitant transfer over Fedwire. Not surprisingly, the rates available to investors in such non-possessory repos are higher than rates offered on standard two-party RPs with collateral delivery. Of course, the risks may be greater as well.

Among the least expensive options for holding repo collateral is the "duebill" or letter repo. Under a letter repo, the borrower, typically a securities dealer, merely sends a transaction confirmation to the lender. Although specific securities might be named as collateral, the lender does not have control of the

securities and relies for the most part on the integrity and creditworthiness of the dealer for protection. Letter repo arrangements are used most often in overnight arrangements involving small par amounts or in transactions with nonwireable securities. Compared with most other common repo arrangements, letter repo arrangements give a dealer greater control over the underlying collateral, enabling the dealer to make last-minute substitutions at low cost if specific securities previously designated as collateral are needed to satisfy other commitments.

A common letter repo arrangement is the "hold-in-custody" repo in which the borrower retains possession of the repo securities but either transfers them internally to a customer account or delivers them to a bulk segregation account or a bulk repo custody account at its clearing bank. The extent to which the investor's interest in the pledged securities is protected depends on the type of custody arrangement. If the borrower acts as both custodian and principal in the transaction, the lender again relies mostly on the borrower's integrity and creditworthiness. Even when a clearing bank is involved, if the securities are held in a bulk segregation account, the bank has no direct obligations to the dealer's individual repo customers; the dealer's customers are identified only in the dealer's own accounting records and not in those of its clearing bank. This contrasts with a bulk repo custody arrangement in which the bank performs some policing functions and also provides some form of direct confirmation to the repo customers.

In situations involving nondelivery of RP collateral, lenders can best protect their claim to repo securities by using "safekeeping" arrangements involving a clearing bank/custodian acting solely in their behalf or jointly as agent for both repo counterparties. The most popular of these arrangements is the "tri-party repo" in which a custodian becomes a direct participant in the repo transaction with the borrower and lender. Tri-party agreements usually are arranged between dealers and major customers with the dealer's clearing bank acting as custodian. The clearer/custodian ensures that exchanges of collateral and funds occur simultaneously and that appropriate operational controls are in place to safeguard the investor's interest in the underlying collateral during the term of the contract. When the repo is arranged, the clearing bank protects the investor's interest in the collateral by making an entry in its internal records transferring the securities from the dealer's general account ("box") to a segregation account. When the repo is unwound at maturity, the clearing bank returns the securities to the dealer's general account and wires the loan repayment to the lender. This typically occurs around 9:00 a.m. ET.

The rates available to investors in tri-party repos are lower than those available on nonsegregated RPs without collateral delivery, but higher than the rates offered on standard two-party RPs with delivery. In general, there is a trade-off between risk and return in the RP market: the greater the control the RP investor (lender) has over his collateral, the lower is his return.

PARTICIPANTS IN THE RP MARKET

Investors A variety of institutional investors, including banks and thrift institutions, nonfinancial corporations, mutual funds, pension funds, and state and local government authorities and other public bodies, derive benefits from RPs and reverse RPs with dealers. RPs enable investors to earn a return above the risk-free rate on Treasury securities without sacrificing liquidity. RPs also offer greater flexibility than other money market instruments because their maturities can be tailored precisely to meet diverse investment needs. In contrast, CDs have minimum maturity at issue of seven days, and commercial paper is seldom written with maturities as short as a day.

Repos are attractive investments for participants subject to "prudent investor" or other types of asset restrictions. Many public bodies, for example, are required by law to invest tax receipts and the proceeds from note and bond sales in Treasury or federal agency issues until the funds are to be disbursed. They regularly invest in repos collateralized by government securities rather than buying the securities outright, and they record the ownership of the securities rather than the repos on their books. The ability to custom-tailor repo maturities and to adjust the amounts invested on a day-to-day basis make repos well suited to the irregular cash flow patterns experienced by these entities. School districts and other local public authorities tend to arrange RP transactions with local banks or smaller dealers, while at the state level, larger dealers and money center banks tend to be the usual counterparties.

Money market mutual funds also are major participants in the RP market. Many funds restrict their repo investments to instruments issued or guaranteed by the U.S. government or federal agencies, but others enter into RPs in any securities in which they are authorized to invest directly. Because RPs are deemed to be loans under the Investment Company Act of 1940 and carry risks not typically associated with direct security investments, mutual funds often limit their RP investments to RPs with maturities of seven days or less that are arranged with member banks of the Federal Reserve System or dealers on the Federal Reserve Bank of New York's list of reporting dealers. Some funds further restrict their agreements to banks above a certain asset size or to institutions whose securities the fund considers eligible to purchase directly.

Dealers Dealers historically have tended to be net borrowers in the RP market, especially in overnight transactions. In some instances, however, dealers have been net lenders of RP funds, the result of shorting securities that were obtained under repo.

Financing Major dealers and large money center banks finance the bulk of their holdings of Treasury and agency securities with RP transactions. Most of these transactions are arranged on a short-term basis (overnight or continuing

contracts) via direct contact with major customers, typically banks, public entities, pension funds, money market mutual funds, and other institutional investors. Early each morning, a dealer's financing desk contacts major customers to arrange repo financing to replace maturing RPs and to meet expected additions to the firm's securities inventory; the financing desk also arranges reverse RPs to cover known or planned short sales and to meet specific customer demands. The bulk of these arrangements are negotiated by 10:00 a.m. ET.[2]

If at the end of the day, a dealer is still in need of funds, it may borrow funds from its clearing bank through a box loan, which is a loan collateralized by any securities in the dealer's general account that have not been allocated to other uses. Such loans are expensive, so dealers use them only as a last resort. A less expensive option for a dealer faced with unexpected financing needs late in the day is to obtain a "position" loan from another bank. When the agreement is finalized, the lending bank wires the specified funds to the dealer's clearing bank, which, in turn, segregates the required amount of the dealer's securities as collateral for the loan and acts as custodian for the lender. The securities are released to the box at the start of business on the following trading day and the loan is repaid.

Reverse RPs and Matched Book Transactions Major dealers commonly use reverse RPs to establish or cover short positions and to obtain specific issues for delivery to customers. This practice is similar to securities borrowing arrangements in which the dealer obtains securities in exchange for funds, other securities, or a letter of credit. Reverses are typically cheaper, however, and provide greater flexibility in the use of collateral, in that they can be arranged for fixed maturities while borrowing arrangements usually may be terminated on a day's notice at the option of the securities lender.

In many instances, a dealer acts as intermediary in the repo market between ultimate borrowers and suppliers of funds. A dealer acts as principal on each side of such arrangements and not as agent, borrowing funds from one party (against the sale of securities) and relending the funds to another party (against the receipt of securities).[3] The combination of RPs and reverses in this fashion is termed a "repo book." A repo book in which an RP and a reverse RP in the same security have equal terms to maturity is referred to as a "matched book." Larger, better-

[2] Dealers generally begin making tentative assignments of collateral to newly arranged RPs by midday, in anticipation of the actual receipt of incoming securities and based on past experience with customer constraints on acceptable collateral. Collateral assignments are subsequently adjusted to cover unanticipated cash trades and to accommodate specific customer needs, including activity of the Domestic Trading Desk of the Federal Reserve Bank of New York.

[3] Dealers engaging in lending arrangements of this sort generally obtain funds in the overnight market from nonfinancial corporate customers, and in turn they lend these funds in the term market to financial institutions.

capitalized dealers are able to profit through arbitrage in matched transactions between smaller dealers and nondealer customers because of the favorable rates at which they obtain RP funds and the differential in the margin taken on the collateral in the two sides of the transaction.

At times, a dealer may choose not to match the maturities of the RPs and reverses in its repo book in an effort to increase profits. If short-term interest rates are expected to rise in the very near term, for example, a dealer might arrange an RP with a longer term than the reverse RP in order to lock in prevailing borrowing rates. Conversely, in a declining rate environment, a longer-term reverse might be financed through a number of shorter-term RPs arranged at successively lower rates.

Brokers If a dealer has exhausted its regular customer base but still is in need of funds or specific collateral, it may contact a repo broker. The repo brokers' market is particularly important as a source of specific issues in short supply ("on special"). Most repo brokers maintain lists of a few hundred customers that are regular repo market participants that they use to satisfy customer requests for funds or collateral. Repo brokers, in contrast to their dealer customers, generally undertake transactions only as agent. Their profits are derived from commissions or spreads on completed transactions. Some brokers restrict their activities solely to agreements between dealers, while others also facilitate transactions between dealers and investors and between investors.

The terms available for transactions in the brokered repo market are displayed on brokers' pages on electronic data services. These screens provide brokers' customers with bid rates at which other repo market participants are prepared to reverse in securities (provide funds) for various lengths of time and offer rates at which they are willing to sell securities (borrow funds) for various lengths of time. A participant who wishes to do a repo can look at his broker's screen to see if there are any bids at the desired maturity for the securities he wishes to sell. If there are none he can have his offer placed on the screen. Similarly, someone who wants to reverse in certain securities can look for offers on the screen and can have his own bid shown on the screen if he sees none.

Federal Reserve In addition to its use as a short-term market for investing and lending funds, the repo market is the primary medium through which the Federal Reserve Bank of New York's Domestic Trading Desk (the Desk) conducts open market operations on behalf of the Federal Reserve System. The Federal Reserve's use of RPs can be traced to around 1917, when RPs were used to provide temporary funds to member banks. Operations with banks were discontinued a few years later and were not resumed until 1975, when bank dealers were included in the list of eligible counterparties. Throughout the 1920s and early 1930s, the Fed continued to conduct RPs with nonbank, dealer

counterparties, but the transactions were used infrequently. In the mid-1940s, RP operations ceased entirely when the Federal Open Market Committee terminated the Desk's authority to conduct RPs on behalf of the System.[4] RPs were not used again until mid-1949. System RP transactions were arranged at fixed rates until 1972, when the current system of competitive bidding for RP funds was implemented. The Fed's use of matched sale-purchase agreements to implement monetary policy directives was begun in July 1966. Currently, most open market operations by the System involve overnight or over-the-weekend RPs and matched sale-purchase transactions with dealers. The Fed's daily transactions frequently total about $1.5 billion to $6 billion.

When the Manager of the System Open Market Account needs to inject reserves into the banking system in a given period to offset a temporary shortage, the Desk enters into RP agreements with selected primary dealers. The initial purchase of securities by the System adds to the supply of nonborrowed reserves. The injection is only temporary, however, in that the extra reserves are subsequently drained when the transaction is unwound at maturity. These agreements usually are arranged overnight or for specified periods up to, but less than, 15 days and are collateralized by Treasury and federal agency securities. Dealers usually are given the option to terminate agreements before maturity.

When reserve projections indicate a need to drain reserves on a temporary basis, the Desk arranges matched sale-purchase agreements with primary dealers. The initial sale of securities by the System causes reserves to be drained from the banking system; the flow of reserves is subsequently reversed when the System repurchases the securities. Matched sale-purchase transactions typically are arranged in Treasury bills, using maturities in which the System has substantial holdings.

In addition to the transactions arranged in the market on behalf of the System Account, the System also provides a temporary pooled cash management facility for foreign official and international accounts. Using the funds in this facility, the Desk provides these accounts with temporary investments in Treasury securities by arranging RPs for them in the market or by arranging MSPs internally with the System Account.

SELECTED REPO ARRANGEMENTS

Although standard overnight and term RP arrangements in Treasury and federally related agency securities are most prevalent, market participants sometimes alter various contract provisions in order to accommodate specific investment needs

[4] Because of the time it takes to complete the accounting for RP transactions, RPs for the System actually are arranged for the account of the Federal Reserve Bank of New York, rather than directly for the System Account, which must be divided each business day among the 12 regional Federal Reserve Banks.

or to provide flexibility in the designation of collateral, particularly in longer-term agreements. Some RP contracts, for example, are negotiated to permit substitutions of the securities subject to the repurchase commitment. Dollar repurchase agreements ("dollar rolls"), in which the initial seller's obligation is to repurchase securities that are substantially similar, but not identical, to the securities originally sold, are included in this category. There are two main types. In a "fixed-coupon dollar roll" the seller agrees to repurchase securities that have the same coupon rate as those sold in the first half of the transaction. A "yield maintenance agreement" is a slightly different and less common variant in which the seller agrees to repurchase securities that provide roughly the same overall market return as the original securities. In each case, the maturity of the repurchased securities must be within an agreed-upon range, but need be only approximately the same as that of the original securities.

Dollar rolls usually are arranged using federally related mortgage-backed securities. For borrowers, typically savings and loan associations, dollar rolls are a low-cost financing vehicle. At the same time, dollar rolls provide the lenders of funds, usually securities dealers, with access to specific mortgage-backed securities for use in covering short sales or satisfying other commitments.

Unlike most coupon-bearing securities, which pay interest semiannually, mortgage-backed securities pay interest monthly, and there may also be unscheduled principal payments as a result of prepayments. These monthly cash flows must be addressed specifically in the contract terms when the maturity of a dollar roll extends beyond month-end. That is, the counterparties must negotiate which of them is to receive the monthly interest and principal payments. In a standard RP, it is common practice for the borrower to receive all coupon interest and final principal payments. In a dollar roll, however, the reverse tends to be true. Dollar rolls are typically structured so that the lender retains any principal and interest earned on the underlying mortgage-backed securities during the "roll" period. Roll periods generally range from 1 to 11 months, with most contracts written for 1 or 3 months.

Repo arrangements can also be structured to provide flexible terms to maturity. In a "reverse to maturity," for example, the initial seller's repurchase commitment is effectively eliminated altogether because the maturity of the agreement covers the remaining term to maturity of the underlying securities. Reverses to maturity typically involve coupon-bearing securities trading at a discount from their book value, the price at which the "seller" initially purchased them. An outright sale under these circumstances would result in a capital loss, which many institutional investors are reluctant to realize. A reverse to maturity overcomes this difficulty by enabling the seller to give up the overall long position in the securities and acquire funds to invest in higher-yielding assets, without having to actually sell the underwater securities outright. The total dollar amount of the seller's repurchase commitment in the transaction depends on the manner

in which the final principal payment on the underlying securities is handled. Usually, the purchaser retains the final payment of interest and principal, which is received directly from the issuer of the securities. This amount is then netted against the seller's repurchase obligation.

Another common repo arrangement with a flexible term to maturity is the so-called flex repo. A flex repo is a term agreement arranged between a dealer and a major customer, typically a corporation, or a municipality or similar authority, in which the customer buys securities from the dealer and may sell some of them back prior to the final maturity date. The funds invested in a flex repo often are intended for use in financing construction or similar projects to be completed in phases. When funds are needed for a given phase of the project, the customer sells the required amount of securities back to the dealer. Under some flex repos, there is a prearranged draw-down schedule, although the investor is not required to adhere to it rigidly. Usually, there is considerable uncertainty regarding the timing of withdrawals. As compensation for accepting the added interest rate risk associated with flex repos, the dealer pays a lower rate than for comparable term agreements. Flex repos usually are collateralized by government-issued or government-backed securities, but dealers are given broad leeway to substitute collateral.

Index repos are term agreements with an underlying interest rate that resets periodically as a function of the federal funds rate, LIBOR, or some other short-term rate. Most indexed repos resemble flex repos in the sense that they are term arrangements that enable the investor to sell securities back to the dealer or buy additional securities as needed. Index repos are used regularly to hedge or finance positions in securities such as floating-rate notes and floating-rate tranches of collateralized mortgage obligations that have rates indexed to the federal funds rate, LIBOR, or other short-term rates. For example, a company that has issued floating-rate debt to finance a pending renovation project can invest the proceeds in an RP agreement tied to the same underlying index. As a result, changes in interest rates during the life of the project will produce offsetting changes in the firm's interest rate expense and its interest earnings.

GROWTH AND DEVELOPMENT OF THE RP MARKET

As a result of the continued growth in the types and volume of arrangements, the RP market has become by most accounts one of the largest and most liquid financial markets in the world. The exact size of the market in terms of total daily activity is unknown. Available data on the volume of activity consist mainly of reports of the repo activities of banks, thrifts, and primary government securities dealers; other market participants are not required to file regulatory reports. Although the reported figures provide only an incomplete picture of the absolute size of the RP market, they help to illustrate how rapidly the market has grown

in recent years. The average daily volumes of RPs and reverse RPs by primary dealers over the past 12 years are shown, respectively, in Tables 1 and 2. The data indicate that average daily activity in repos and reverses by major dealers has more than doubled since the mid-1980s and has increased roughly tenfold since 1981. The same is true of matched transactions, which are shown as memoranda items to the tables. The favorable financing rates, flexible maturities, and variety of terms and collateral arrangements available likely have led to a similar expansion in the use of repo transactions by other market participants as well.

TABLE 1

Volume of Repurchase Agreements

by Term of Contract*

(millions of dollars)

Year	Overnight and Continuing†	Term Agreements†	Total†	Memorandum: Matched Book
1981	35,641	29,578	65,219	29,074
1982	51,725	43,495	95,220	47,942
1983	58,029	44,486	102,515	45,009
1984	75,836	57,248	133,084	63,153
1985	103,612	70,149	173,760	79,745
1986	141,943	102,459	244,402	120,390
1987	170,749	121,216	291,965	163,963
1988	172,720	137,046	309,766	191,164
1989	219,115	179,699	398,815	236,198
1990	236,958	185,210	422,168	272,666
1991	282,487	211,566	494,053	309,845
1992	346,359	282,954	629,313	398,235

*Figures are obtained from reports submitted weekly to the Federal Reserve Bank of New York by the U.S. government securities dealers on its published list of primary dealers.

†Figures include matched agreements.

Note: Details may not add to totals because of rounding.

TABLE 2

Volume of Reverse Repurchase Agreements

by Term of Contract*

(millions of dollars)

Year	Overnight and Continuing†	Term Agreements†	Total†	Memorandum: Matched Book
1981	14,667	32,016	46,683	28,341
1982	26,729	48,348	75,078	47,910
1983	29,275	52,650	81,925	46,533
1984	44,200	68,578	112,778	66,315
1985	68,100	80,650	148,750	83,186
1986	99,048	108,628	207,676	123,628
1987	126,700	148,310	275,010	168,348
1988	136,394	177,474	313,868	198,127
1989	157,926	225,184	383,110	246,213
1990	159,272	221,658	380,930	279,238
1991	181,288	235,841	417,129	311,508
1992	209,956	304,620	514,576	410,358

*Figures are obtained from reports submitted weekly to the Federal Reserve Bank of New York by the U.S. government securities dealers on its published list of primary dealers.

†Figures include matched agreements.

Note: Details may not add to totals because of rounding.

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Chapter 7
TREASURY BILLS

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Treasury bills are short-term securities issued by the U.S. Treasury. The Treasury sells bills at regularly scheduled auctions to refinance maturing issues and to help finance current federal deficits. It also sells bills on an irregular basis to smooth out the uneven flow of revenues from corporate and individual tax receipts. Persistent federal deficits have resulted in rapid growth in Treasury bills in recent years. At the end of 1992 the outstanding volume was $658 billion, the largest for any money market instrument.

TREASURY BILL ISSUES

Treasury bills were first authorized by Congress in 1929. After experimenting with a number of bill maturities, the Treasury in 1937 settled on the exclusive issue of three-month bills. In December 1958 these were supplemented with six-month bills in the regular weekly auctions. In 1959 the Treasury began to auction one-year bills on a quarterly basis. The quarterly auction of one-year bills was replaced in August 1963 by an auction occurring every four weeks. The Treasury in September 1966 added a nine-month maturity to the auction occurring every four weeks but the sale of this maturity was discontinued in late 1972. Since then, the only regular bill offerings have been the offerings of three- and six-month bills every week and the offerings of one-year bills every four weeks. The Treasury has increased the size of its auctions as new money has been needed to meet enlarged federal borrowing requirements. In 1992 the weekly auctions of three- and six-month bills both ranged from $10.2 billion to $12.5 billion, and the four-week auctions of one-year bills ranged from $12.8 billion to $15.0 billion.

In addition to its regularly scheduled sales, the Treasury raises money on an irregular basis through the sale of cash management bills, which are usually "reopenings" or sales of bills that mature on the same date as an outstanding issue of bills.[1] Cash management bills are designed to bridge low points in the

[1]Prior to 1975, the Treasury raised funds on an irregular basis through the sale of tax anticipation bills. Nelson (1977) provides a description of these bills.

Treasury's cash balances. Many cash management bills help finance the Treasury's requirements until tax payments are received. For this reason they frequently have maturities that fall after one of the five major federal tax dates. Sixty issues of cash management bills were sold in the decade from 1983 through 1992. Of these, 29 had maturities of less than one month, 21 had maturities between one month and three months, and 10 had maturities between three months and one year.

Auctioning New Bills Weekly offerings of three- and six-month Treasury bills are typically announced on Tuesday. The auction is usually conducted on the following Monday, with delivery and payment on the following Thursday. Bids, or tenders, in the weekly auctions must be presented at Federal Reserve Banks or their branches, which act as agents for the Treasury, by 1:00 p.m. New York time on the day of the auction.[2] Bids may be made on a competitive or noncompetitive basis. Competitive bids are generally made by large investors who are in close contact with the market. In making a competitive bid the investor states the quantity of bills he desires and the price he is willing to pay per $100 of face value. He may enter more than one bid indicating the various quantities he is willing to take at different prices. Since September 1981 the Treasury has set a limit of 35 percent on the amount of any security offering awarded to a single bidder, and since July 1990 it has also set a 35 percent limit on the amount of bids tendered at any one yield by a single bidder.

In making a noncompetitive bid the investor indicates the quantity of bills desired and agrees to pay the weighted-average price of accepted competitive bids. Individuals and other small investors usually enter noncompetitive bids, which are limited to $1 million for each new offering of three- and six-month bills. In recent years the dollar amount of noncompetitive awards as a percent of total awards has generally ranged from 10 to 25 percent of the total auction amount. As shown in Figure 1, the percent awarded to noncompetitive bids typically rises in periods of high interest rates. (A reason for this is suggested below.)

After subscription books at the various Federal Reserve Banks and branches are closed at 1:00 p.m., the bids are tabulated and submitted to the Treasury for allocation. The Treasury first allocates whatever part of the total offering is needed to fill all the noncompetitive bids. The remainder is then allocated to those competitive bidders submitting the highest bids, ranging downward from the highest bid until the total amount offered is allocated. The "stop-out price" is the lowest price, or highest yield, at which bills are awarded. Usually only a portion of the total bids made at this price is accepted. The average issuing price is then computed as a weighted average of the competitive bids accepted.

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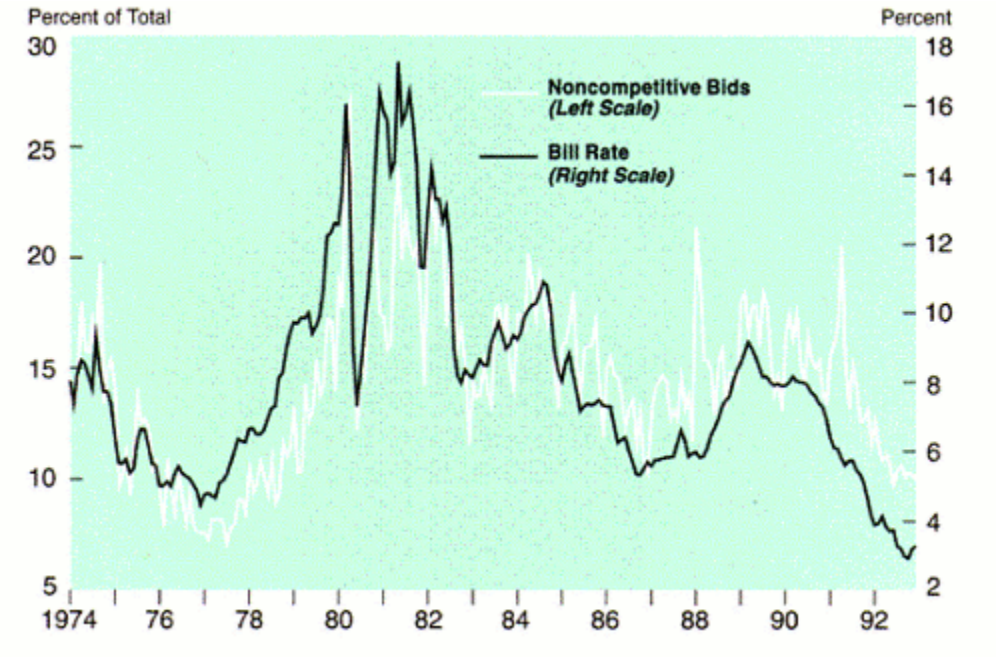
[2] For a detailed description of the mechanics of purchasing Treasury bills, see Federal Reserve Bank of Richmond (1993).

FIGURE 1

Noncompetitive Bids at Weekly Auction

Compared to Level of Rates



Note: Monthly data are averages of weekly figures.

Source: *Treasury Bulletin; Federal Reserve Bulletin.*

In the weekly auction of March 9, 1992, for example, accepted bids for the three-month bills ranged from a high of $98.989 per $100 of face amount (equivalent to an annual rate of return on a discount basis of 4.00 percent) to a stop-out price of $98.984 (4.02 percent). Accepted bids for the six-month bills ranged from $97.917 (4.12 percent) to $97.907 (4.14 percent). Twelve percent of the total of $22.9 billion of bills awarded at this auction was purchased on a noncompetitive basis at the average issuing prices. This relatively small proportion was typical given the low level of interest rates prevailing at the time of the auction.

In addition to the regular weekly auction, one-year bills are auctioned every fourth Thursday for issue the following Thursday and special auctions are held for cash management bills. The procedure for these auctions is similar to the weekly auctions.

Treasury bills are issued in book-entry form to the successful bidders at the auctions. Under this arrangement ownership is recorded in computers at the Federal Reserve, the Treasury, or depository institutions. There are two book-entry

systems. The first, called the commercial book-entry system, is designed for large investors who bid competitively at the auctions. In this system the Federal Reserve maintains book-entry accounts for depository institutions, who maintain accounts for large investors such as dealers, brokers, and institutional investors, who in turn keep accounts for their own customers. The second system, called TREASURY DIRECT, is designed for small investors who bid noncompetitively and plan to hold their securities until maturity. Under this system noncompetitive bidders have their ownership recorded directly in book-entry accounts at the Department of the Treasury. If users of the TREASURY DIRECT system wish to sell their securities prior to maturity, they must transfer them to the commercial book-entry system. To do this they have to make arrangements with a depository institution that has an account at a Federal Reserve Bank and pay the institution whatever fees are involved in carrying out this transaction.

When-Issued Trading in Bills In the ten or so days between the announcement of a bill auction and the actual issuance of the securities to the winning bidders there is an active forward market in the bills, called the when-issued market. In this market dealers make forward commitments with each other and with their customers to buy and sell the securities after they are issued. When-issued yields provide market participants with an indication of the likely yields at the auctions, and when-issued trading plays an important role in distributing the securities when they are issued. One study found that primary dealers had an average net short position equal to almost 40 percent of the notes and bonds awarded to them in Treasury auctions from January 1990 through September 1991 (Department of the Treasury et al. 1992, p. B-63). This indicates that prior to the auctions the primary dealers sell in the when-issued market a substantial portion of the securities subsequently awarded to them in the auctions.

Auction Procedures and the Joint Report on the Government Securities Market In a number of Treasury auctions in late 1990 and early 1991, a major securities dealer violated the rules limiting to 35 percent the amount of any security offering awarded to a single bidder and the amount of bids tendered at any one yield by a single bidder. In exceeding these limits the dealer was reportedly able to create a shortage of these issues in the market (a "squeeze") from which it then profited. Largely in reaction to this and other abuses, the Treasury, the Securities and Exchange Commission, and the Board of Governors of the Federal Reserve System prepared a "Joint Report on the Government Securities Market" (1992) in which they made numerous recommendations for changes in policies affecting the U.S. securities market.[3]

[3] The Joint Report provides a wealth of information on the U.S. government securities market. The automation of the auction process and the alternative auction procedures are discussed on pages 13-16 and Appendix B. The events surrounding the violation of the auction rules are described in Appendix C.

One recommendation of the report was to accelerate Federal Reserve projects already underway that would lead to automation of the auction procedure. These projects will eventually make it possible to replace the manual bidding system with an electronic bidding system that will enable investors to submit bids to the Federal Reserve by computer. An advantage of automation cited by the Joint Report is that it will allow many investors who formerly placed their bids through the major dealers to bid directly for themselves, which should diminish the information advantage possessed by the large dealers under the manual bidding system.

The Joint Report also recommended that following the completion of automation the current auction system be replaced by an "ascending price, open-outcry" procedure in which bidding would be conducted openly in successive rounds. Under this system the Treasury would continue to raise the offering price on an issue of securities until it reached a price at which the quantity demanded fell below the quantity it wanted to sell. The Treasury would then sell the whole issue at the previous price (i.e., the highest price at which all the securities were bid for). A potential advantage of this system cited in the Joint Report is that it would allow participants to react during the auction to surprise bids by other participants, which would make it more difficult for a particular dealer to corner a security. (Reinhart [1992] provides an analysis of potential Treasury auction techniques.)

Many analysts have argued that moving to a uniform (or "single") price auction is the most important reform the Treasury could make in its auction procedures. They reason that a single price auction reduces the potential risk faced by uninformed or aggressive bidders of bidding too high a price (the so-called winner's curse). Hence, they argue, the average bid in single price auctions would be higher than under the current auction procedure and the average revenue received by the Treasury would be greater. To test this theory the Treasury in September 1992 began a year-long experiment in which it used single price auctions to sell monthly new issues of two-year and five-year notes. These auctions—like regular Treasury auctions—allocated securities to investors making the highest bids, ranging downward from the highest bid to lower bids until all an issue was allocated. The only difference was that the winning bidders all paid the same price, which was the price offered by the lowest bidder to whom securities were allocated. (Vogel [1993] provides an early evaluation of the auction procedure.)

INVESTMENT CHARACTERISTICS

Four investment characteristics of Treasury bills distinguish them from other money market instruments. These are (1) lack of default risk, (2) high liquidity, (3) favorable tax status, and (4) a low minimum denomination.

Default Risk Treasury bills are generally considered to be free of default risk because they are obligations of the federal government. In contrast, even the highest grade of other money market instruments, such as commercial paper or certificates of deposit (CDs), is perceived to have some degree of default risk. Concern over the default risk of securities other than Treasury securities typically increases in times of weak economic conditions, and this tends to raise the differential between the rates on these securities and the rates on Treasury bills of comparable maturity (discussed below).

Because Treasury bills are free of default risk, various regulations and institutional practices permit them to be used for purposes that often cannot be served by other money market instruments. For example, banks use bills to make repurchase agreements free of reserve requirements with businesses and state and local governments, and banks use bills to satisfy pledging requirements on state and local and federal deposits. Treasury bills are widely accepted as collateral for selling short various financial securities and can be used instead of cash to satisfy initial margin requirements against futures market positions. And Treasury bills are always a permissible investment for state and local governments, while many other types of money market instruments frequently are not.

Liquidity A second characteristic of bills is their high degree of liquidity, which refers to the ability of investors to convert them into cash quickly at a low transactions cost. Investors in Treasury bills have this ability because bills are a homogeneous instrument and the bill market is highly organized and efficient. A measure of the liquidity of a financial asset is the spread between the price at which securities dealers buy it (the bid price) and the price at which they sell it (the asked price). In recent years the bid-asked spread on actively traded bills has been 2 basis points or less, which is lower than for any other money market instrument.

Taxes Unlike other money market instruments, the income earned on Treasury bills is exempt from all state and local income taxes. The relationship between, say, the CD rate (*RCD*) and the bill rate (*RTB*) that leaves an investor with state income tax rate *t* indifferent between the two, other considerations aside, is

$$RCD(1 - t) = RTB.$$

From this formula it can be seen that the advantage of the tax-exempt feature for a particular investor depends on (1) the current level of interest rates and (2) the investor's state and local tax rate. For an investor to remain indifferent between bills and CDs, the before-tax yield differential (*RCD* - *RTB*) must rise if the level of interest rates rises or if the investor's tax rate increases. For example, the interest rate differential at which an investor subject to a marginal state tax rate of

6 percent is indifferent between CDs and bills rises from 32 basis points when the Treasury bill rate is 5 percent to 64 basis points when the bill rate is 10 percent. And with a 5 percent Treasury bill rate, the interest rate differential at which an investor is indifferent between CDs and bills rises from 32 basis points when the investor's tax rate is 6 percent to 43 basis points when his tax rate is 8 percent.

This characteristic of bills is relevant only for some investors. Other investors, such as state and local governments, are not subject to state income taxes. Still other investors, such as commercial banks in many states, pay a "franchise" or "excise" tax that in fact requires them to pay state taxes on interest income from Treasury bills.[4]

Minimum Denomination A fourth investment characteristic of Treasury bills is their relatively low minimum denomination. Prior to 1970, the minimum denomination of bills was $1,000. In early 1970 the Treasury raised the minimum denomination from $1,000 to $10,000. The Treasury made this change in order to discourage noncompetitive bids by small investors, reduce the costs of processing many small subscriptions yielding only a small volume of funds, and discourage the exodus of funds from financial intermediaries and the mortgage market. Despite the increase in the minimum denomination of bills, investors continued to shift substantial amounts of funds out of deposit institutions into the bill market in periods of high interest rates such as 1973 and 1974. Even at $10,000 the minimum denomination of Treasury bills is far below the minimum denomination required to purchase other short-term securities, with the exception of some government-sponsored enterprise and municipal securities. Typically, it takes at least $100,000 to purchase money market instruments such as CDs or commercial paper.

INVESTORS

Because of their unique investment characteristics Treasury bills are held by a wide variety of investors. Available information suggests that individuals, commercial banks, the Federal Reserve, money market mutual funds, and foreigners are among the largest investors in bills. Other investors in Treasury bills are nonbank financial institutions, nonfinancial corporations, and state and local governments.

Because Treasury bills have a relatively low minimum denomination and can be purchased at Federal Reserve Banks and branches without any service charge, the direct investment by individuals in bills has been greater than in any other money market instrument. (Since the late 1970s individuals have been heavy indirect investors in all money market instruments through their investment in

[4] Details on the taxation of Treasury bill interest income for different investors are provided in Cook and Lawler (1983).

money market funds.) The percentage of bills awarded to noncompetitive bidders at the weekly Treasury bill auctions is a widely used barometer of individual investment activity in the bill market. Figure 1 shows that this percentage is positively related to the level of interest rates. In recent years the major reason for this relationship appears to be that individuals as a group benefit most from the exemption of Treasury bill interest income from state and local income taxes. For a given spread between Treasury bill and other money market rates this exemption makes bills more attractive—relative to other short-term investments—the higher the level of interest rates. Hence, investment in bills by individuals rises with the level of interest rates.

Commercial banks' holding of Treasury bills tends to vary inversely with the demand for business loans. When loan demand is slack, banks increase their holdings of bills and other Treasury securities. Conversely, when loan demand is increasing, banks reduce their holdings of Treasury securities in order to expand loans. Of course, banks finance increases in business loans not only through the sale of securities but also through the issuance of liabilities such as CDs. Further, as noted above, banks also use Treasury bills to satisfy various collateral requirements and to make repurchase agreements with businesses and state and local governments. At the end of 1992 commercial banks held $236 billion of U.S. Treasury securities, and a rough estimate is that about $43 billion of this was Treasury bills.

The Federal Reserve's holdings of Treasury bills at year-end 1992 was $142 billion, which represented about half its total holdings of Treasury securities. The Fed changes the level of reserves available to depository institutions primarily through the purchase and sale of Treasury bills, either outright in the bill market or on a temporary basis in the market for repurchase agreements (RPs). RPs have a temporary effect on the supply of bank reserves and are typically used to offset temporary fluctuations in reserves arising from other sources, such as changes in Treasury deposits at the Federal Reserve Banks. On a day-to-day basis most Federal Reserve operations are RPs. The increase in the Fed's outright holdings of bills over long periods of time reflects permanent increases in the level of reserves and the money supply.

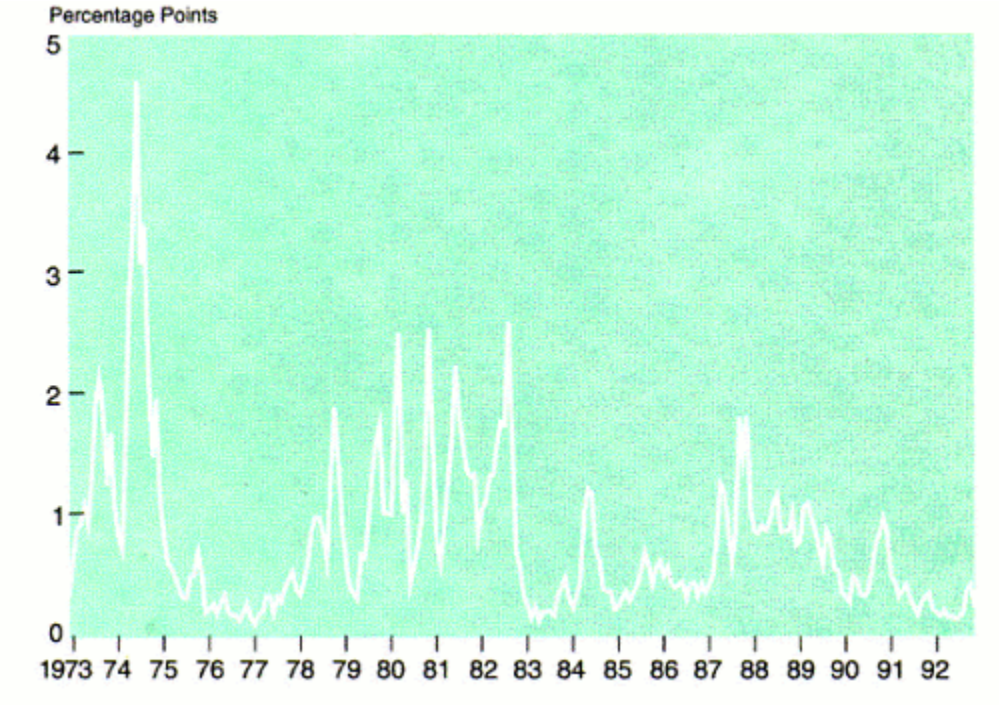
Money market mutual funds held $47 billion of Treasury bills at year-end 1992, representing 10.5 percent of their total assets. Some money market funds limit their assets to U.S. Treasury securities in order to appeal to the most risk-averse investors. These funds held $19 billion in assets at the end of 1992. In recent years almost all states have passed legislation permitting the pass-through from a money market fund to its shareholders of the exemption of Treasury bill interest income from state and local income taxes.

According to Treasury Department estimates, at the end of 1992 foreigners held $126 billion of Treasury bills (including some nonmarketable certificates of indebtedness), $105 billion of which was held by foreign official institutions.

FIGURE 2

The Spread Between the Three-Month CD

and Treasury Bill Rates



Source: Board of Governors of the Federal Reserve System.

The holdings of bills by foreign official institutions are heavily influenced by their activities in the foreign exchange markets. From 1986 through 1988, for example, these institutions were buying dollars in an attempt to limit the dollar's depreciation over this period, and as a result their holdings of bills rose sharply from $53 billion in December 1985 to $104 billion in December 1988.

YIELDS

Yield Calculation Treasury bill yields are generally quoted on a discount basis using a 360-day year. The yield on a discount basis is calculated by dividing the discount (the difference between the face value of the bill and its purchase price) by the face value and expressing this percentage at an annual rate, using a 360-day year. For example, in the weekly auction of March 9, 1992, discussed above, an average price of $97.912 per $100 of face amount for a six-month (182-day) bill produced an annual rate of return on a discount basis of

(100 - 97.912/100) x (360/182) = 4.13%

To calculate the true yield of a Treasury bill for comparison with other money market yields, the discount must be divided by the *price* and a 365-day year used. In the above example the true yield is[5]

(100 - 97.912/97.912) x (365/182) = 4.28%

As this example illustrates, the yield calculated on a discount basis understates the true yield of a Treasury bill.[6] The difference between the two yields is greater the longer the maturity of the bill and the higher the level of interest rates.

Yield Spreads Most money market rates move together closely over time. Perhaps more than any other money market rate, however, the rate on Treasury bills has at times diverged substantially from other short-term rates. Figure 2 shows that the differential between the three-month prime CD rate and the three-month Treasury bill rate varies greatly over time.

The most common explanation of the spread between Treasury bill and other money market rates focuses on default risk. According to this explanation, the spreads between other short-term rates and bill rates vary over time because of a cyclical risk premium pushing up the yields on private sector money market instruments relative to the yields on Treasury bills in periods of weak economic activity. Throughout the money market, spreads between yields of securities that differ in their degree of default risk typically rise in recessions. (See, for example, the spread between the prime and medium-grade commercial paper rates shown in the commercial paper chapter.) Default risk can also cause the spread to rise in periods of concern over the health of the financial system. One major such episode occurred in the late summer and fall of 1982 when the failure of a securities dealer, along with heightened concern over the ability of some foreign countries to pay off loans to U.S. commercial banks, increased investor worries over the soundness of the nation's financial system and resulted in a sharp increase of almost a full percentage point in the spread between CD and bill rates.

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[5] The yield calculated in this fashion is sometimes called a "simple" yield because it is annualized without any compounding. It is also called a "coupon-equivalent" yield for Treasury bills with maturities up to six months. (The coupon-equivalent formula is more complicated for longer-term Treasury bills. See Federal Reserve Bank of Richmond [1993].)

[6] The formula to convert a discount yield (*rd*) to a true yield (*r*) is:

$$r = (365 \times rd) / (360 - [rd \times t]),$$

where *t* is days to maturity and the interest rates are expressed in decimal form.

Another possible factor influencing the spread between the bill rate and other short-term rates is the exemption of Treasury bills from state and local income tax. As noted above, the higher the level of interest rates the wider the spread between bill rates and other short-term rates that is necessary to leave an investor with a given state income tax rate indifferent between bills and other money market instruments. Consequently, as interest rates rise, this tax feature of bills induces some investors to increase their purchases of bills, thereby putting upward pressure on the spread between bill rates and other rates. Evidence in favor of this effect is that the spread typically rises in high interest rate periods and falls in low interest rate periods.

This is not to say that the tax-exempt feature of bills must cause the spread to rise with the level of interest rates. As noted above, many investors in the bill market are not subject to state and local income taxes. If, however, investors subject to state income tax rate *t* dominate the bill market, then the observed relationship between the CD rate (*RCD*) and the bill rate (*RTB*)—taking default risk into account—will be:

$$RCD(1 - t) = RTB + \text{Default Risk Premium}.$$

One study (Cook and Lawler 1983) using data from 1979 through mid-1983, when the spread between the CD and Treasury bill rates was particularly volatile, found that the simple model represented by the equation above did a good job of explaining the spread in that period. This study estimated that the average value of *t* over that period was in the neighborhood of 8 percent, which is well within the range of state individual income tax rates on interest income. Another study (Simon 1992) using data from 1980 through 1991 estimated a value of *t* of 7 percent.

A third factor that may at times influence the spread between Treasury bill rates and other money market rates is the supply of Treasury bills relative to the supply of other money market securities. For example, Simon (1992) provides evidence that the rise in the spread in 1987 and 1988 resulted partly from the Tax Reform Act of 1986, which led to a sharp inflow in Treasury revenues and a substantial decline in the outstanding supply of Treasury bills.

A final factor that prior to the late 1970s may have affected the spread in periods of high interest rates such as 1969, 1973, and 1974 is disintermediation. In these periods the large differential between market interest rates and Regulation Q ceiling rates at the depository institutions induced many individuals to move their funds out of these institutions and into the bill market. The large purchases of Treasury bills by individuals in these periods may have driven bill rates down relative to the rates on other money market instruments (Cook 1981). Ceilings on savings-type deposits at depository institutions were partially eliminated in 1978 with the introduction of $10,000 money market certificates and then almost completely eliminated in late 1982 with the introduction of money market deposit accounts (MMDAs).

Yield Curves An interesting aspect of the Treasury bill yield curve is that it has been upward-sloping most of the time. As a result, investors have generally earned a higher return—usually called a "term premium"—for investing in longer-term bills. In other words, on average investors have earned a higher return on six-month bills than on three-month bills and a higher return on three-month bills than on one-month bills. A common procedure to estimate the average term premium on a bill maturing in more than one month is to calculate over a long period of time the difference between the return from investing in this bill for one month and the return from investing in a one-month bill. The literature in this area has found that the average term premium in the bill market increases at a decreasing rate out to around six months, and then flattens out (McCulloch 1987; Cook and Hahn 1990).

The most common explanation for the term premium in the bill market is that investors require a higher yield on longer-term bills because of the greater price volatility of longer-term bills when interest rates change. Also, as noted above, bills can be used to satisfy numerous institutional and regulatory requirements such as serving as collateral for tax and loan accounts at commercial banks and satisfying margin requirements on futures contracts. To the extent that investors hold bills for these purposes for relatively short periods, they might prefer to minimize capital risk by holding short-term bills.

Special Factors Affecting Individual Bill Yields It is widely believed in the financial markets that a shortage or abundance of a particular bill issue can cause that issue's yield to differ significantly from the yields on surrounding maturities. In support of this idea, there is evidence that the announcement of a cash management bill that adds to the supply of outstanding bills of a certain maturity causes the yield on bills of this maturity to rise significantly relative to the yields on adjacent maturity bills (Simon 1991). It has also been documented that Treasury bills maturing at the end of the month tend to have lower yields than bills maturing earlier in the month (Park and Reinganum 1986). One explanation for this phenomenon is that businesses and governments make a disproportionate amount of payments at the end of the month and therefore have a preference for bills that mature at that time (Ogden 1987).

SECONDARY MARKET[7]

The market for Treasury bills is the largest and most efficient for any money market instrument. At the heart of this market is a group of securities dealers designated by the Federal Reserve as primary dealers, who purchase a large

[7] For more detail on the secondary market for Treasury securities see General Accounting Office (1985), Department of the Treasury et al. (1992), and McCurdy (1977-78).

portion of the Treasury bills sold at auction and make an active secondary market for these securities. Primary dealers are expected by the Federal Reserve to make markets in the full range of U.S. government securities, to participate meaningfully in Treasury auctions, to be active participants in the Federal Reserve's open market operations, and to provide the Federal Reserve with market information (Federal Reserve Bank of New York 1988). As of June 1992 there were 39 primary dealers, about one-third of which were departments of commercial banks and two-thirds of which were nonbank dealers. In addition to the primary dealers, there are several hundred other bank and nonbank dealers in government securities.

The primary dealers make markets by buying and selling securities for their own account. The marketplace is decentralized with most trading transacted over the telephone. Daily trading in Treasury bills by the primary dealers in 1992 averaged $40.2 billion. The dealer's major customers include depository institutions, nonfinancial corporations, state and local governments, insurance companies and pension funds. Dealers also trade actively with each other, mostly through brokers who match buyers and sellers for a commission. Brokers display bid and asked prices via electronic screens located in the trading rooms of the primary dealers, thereby providing them with rapid access to this information, yet maintaining the anonymity of buying and selling dealers.

The spread between the yields bid and asked by dealers on Treasury bills varies over time, largely depending on the volatility of interest rates. The more volatile are interest rates, the greater the spread required by dealers in compensation for the risk of taking a position. Hence, bid-asked spreads tend to rise in periods of increased interest rate volatility. For example, in October 1979 the Federal Reserve announced a change in its operating procedures that resulted in much greater volatility in short-term interest rates, and the bid-asked spread on the most actively traded three-month Treasury bills rose from 2 basis points to as high as 8 to 10 basis points. (The chapter on federal funds describes Federal Reserve operating procedures.) In late 1982 the Fed reverted to a procedure similar to its pre-October 1979 procedure and the bid-asked spread subsequently fell to 2 basis points or less.

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Chapter 8
SHORT-TERM MUNICIPAL SECURITIES

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INTRODUCTION

Municipal securities are debt securities issued by state and municipal governments and the special districts and statutory authorities they establish. States and municipalities borrow to finance their own expenditures, to provide funds to some tax-exempt entities such as colleges and nonprofit hospitals, and, to a limited degree, to provide funds to private firms and individuals.[1] State and local governments can borrow at favorable rates because the interest income received by holders of most municipal securities is exempt from federal taxes.

Market participants generally call municipal securities short-term if they have maturities of less than three years or if they have features that shorten their effective maturities to less than three years.[2] The municipal market includes several short-term financing vehicles. Notes such as bond anticipation notes, tax anticipation notes, and revenue anticipation notes provide funds for short periods and are repaid from the proceeds of bond issues, taxes, or revenue-producing projects. Tax-exempt commercial paper and variable-rate demand obligations enable state and municipal issuers to fund long-term projects at short-term rates. Swaps, municipal preferred stock, and floaters/inverse floaters allow issuers to borrow at fixed rates for the long term while providing investors with floating-rate, short-term debt. During 1991 approximately $58 billion in short-term municipal securities were issued compared with $219 billion in total municipal debt, both long- and short-term.[3]

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[1] In this chapter the term "municipality" refers to local governments and to the special districts and authorities created by state and local governments. Some writers use the term to refer to state governments as well.

[2] Most major data-collecting firms consider municipal securities short-term if they have maturities of no more than 12 or 13 months or if they have features that make their effective maturities no more than 12 or 13 months. The figures quoted throughout the chapter are based upon this criterion.

[3] Figures were provided by Securities Data Company, Inc., New York. Figure for short-term municipal securities includes notes, tax-exempt commercial paper, and variable-rate demand obligations.

CHARACTERISTICS OF SHORT-TERM MUNICIPAL SECURITIES

Short-term municipal securities are issued in either coupon or discount form. Coupon securities, the most prevalent by far, pay a stated tax-exempt interest rate, called the coupon rate, at maturity or on specified dates. The coupon rate varies over the life of the issue in the case of variable-rate instruments. Discount securities do not carry a coupon. Rather, they are issued at a price less than their face value and the difference between the issue price and face value is tax-exempt interest income.

Short-term municipal securities are normally issued in denominations of $5,000 or more. The denomination chosen depends upon the issuer's assessment of who the purchasers are likely to be. If the issuer is trying to sell to individuals, it will use a smaller denomination than if it is trying to sell to institutional investors.

Short-term municipal securities can be either general obligation securities or revenue securities. General obligation securities are backed by the full faith and credit of the issuer, which uses taxes and other possible sources of income to meet debt payments. The ability to tax may be limited by law, in which case the general obligation security is called a limited tax security. Revenue securities are generally backed by revenues associated with the projects the securities finance and not by the full faith and credit of the issuers. The revenues are usually earnings generated by projects; for instance, as tolls from roads or connection fees and charges paid by users of water systems. In some cases, however, the revenues are funds from specific taxes, receipts from bond sales, or transfers from the federal government. Table 1 lists the major issuers of municipal debt and the types of securities they normally issue.

Many districts and authorities cannot tax, so they do not have the ability to make general obligation pledges. Consequently, most of the securities issued by special districts and statutory authorities are backed by revenues from the projects the securities finance. At times, however, the securities of such districts and authorities are backed by general obligation pledges from the state or local governments that founded them.

The interest income earned on most of the debt issued by states and municipalities is exempt from federal taxes. The tax exemption allows states and municipalities and whatever private entities they finance to obtain funding more cheaply than they otherwise could. It is, in effect, a subsidy from the federal government. In recent years, Congress has taken steps to limit access to the subsidy and to prevent states and municipalities from taking advantage of it by investing the proceeds of tax-exempt securities in taxable securities that pay higher rates.

Over the last decade, Congress has placed greater and greater restrictions on who can issue tax-exempt obligations and for what purposes. So far it has not attempted to tax interest income on municipal debt used to finance the provision of governmental services, although in April 1988 the Supreme Court ruled that

TABLE 1

Issuers of Short-Term Municipal Securities and Types of Debt Issued

Issuer	Types of Debt Generally Issued
State government	G.O. and revenue
Local government:	G.O. and revenue
City	G.O. and revenue
County	G.O. and revenue
Authorities, districts, and agencies created by state and local governments:	
Public school	G.O. and revenue
Higher education	G.O. and revenue
Public power	Revenue
Water or sewer	Revenue
Transportation	Revenue
Health facilities	Revenue
Student loan	Revenue
Housing finance	Revenue
Waste management	Revenue

Note: G.O. denotes general obligation.

it has the power to do so. The most important restrictions were introduced by the Tax Reform Act of 1986, which limited private-purpose municipal debt to certain uses and imposed state-by-state limitations on such debt. In addition, the Act redefined private-purpose debt to make circumvention of the limitations more difficult. (The provisions of the Tax Reform Act affecting the municipal debt markets are outlined in the box on page 92.)

These limitations halted the rise in the use of private-purpose, tax-exempt debt that had occurred over the preceding decade. Tax-exempt debt issued for the benefit of businesses and nonprofit organizations (which accounts for most of the private-purpose tax-exempt debt) had risen from 4 percent of all tax-exempt borrowing in 1975 to 32 percent in 1985, but within three years after the passage of the Act it fell to 24 percent of all tax-exempt debt outstanding (Board of Governors 1990, pp. 43-44). Some municipal borrowers have issued taxable securities to finance private-purpose activities.

In the Tax Reform Act of 1986, Congress took steps to limit the ability of tax-exempt issuers to earn profits from investing the proceeds of tax-exempt issues in higher interest rate taxable securities. First, it required that such arbitrage

FEATURES OF THE TAX REFORM ACT OF 1986

- Lowered the top marginal tax rate for individuals from 50 percent to 33 percent and lowered the top marginal tax rate for corporations from 51 percent to 39 percent.
- With the exception of certain small issues of debt and debt purchased on or before August 7, 1986, ended depository institutions' ability to deduct from income the interest expense of carrying tax-exempt debt.
- Included in corporate and individual minimum income tax calculations tax-exempt interest income from newly issued (issued after August 7, 1986) private-activity bonds.
- Changed the definition of a private-activity security so that a municipal security is a private-activity security if something other than a governmental unit uses more than 10 percent of the proceeds or provides more than 10 percent of the repayment. Prior to the Act the cutoff had been 25 percent.
- Placed state-by-state limits on the amount of certain private-activity, tax-exempt debt. After 1987 annual new issues of private activity, tax-exempt debt were limited to $50 per capita or $150 million, whichever is greater.
- Restricted tax-exempt, private-activity debt to charitable uses, to certain small debt issues, and to use for certain specified infrastructure and waste disposal facilities.
- Limited the ability of issuers to earn arbitrage profits and restricted advance refunding issues.

profits be returned to the federal government. It also greatly limited advance refunding issues, which are securities issued ostensibly to fund the retirement of other securities but issued well before their date of maturity, because the proceeds of such issues offer the opportunity for arbitrage profits.

THE INSTRUMENTS

Notes States and municipalities issue notes to bridge the gap between expenditures and the receipt of funds from bond issues, taxes, grants, income-generating projects, or new issues of notes. One type of note frequently used by states and municipalities is the bond anticipation note (BAN) which is paid off with funds from a bond issue. Suppose a state or municipality plans to finance a construction project with bonds. Rather than issuing bonds before the project is finished and

the final costs are certain, the state or municipality may first sell notes that will be retired with the proceeds of bonds issued upon completion of the project. For example, in 1990 Arlington County, Virginia, issued $47 million in two-year, fixed-rate bond anticipation notes to fund public improvements. The notes were general obligation securities backed by the full faith and credit of the county. When they matured in 1992 the county paid them off by issuing new two-year BANs which were then repaid with the proceeds of bond sales in 1994. In this example, while the immediate source of repayment of the BANs maturing in 1992 was another BAN issue, not a bond issue, the notes in the first issue were called BANs because they were ultimately repaid with proceeds of the 1994 bond issue.

Notes are also issued in anticipation of receipts from taxes, grants, and fee-generating projects. These notes are generally named according to the source of repayment. Popular notes are revenue anticipation notes (RANs), tax anticipation notes (TANs), grant anticipation notes (GANs), and tax and revenue anticipation notes (TRANs).

Notes generally have minimum denominations of $5,000. Maturities are generally less than one year, though some have maturities of up to three years. Repayment comes from funds available on or before the maturity date. In 1991 states and local governments issued $42 billion in notes which accounted for about 72 percent of all short-term municipal securities issued that year (see Figure 1).

Tax-Exempt Commercial Paper and Variable-Rate Demand Obligations Tax-exempt commercial paper is short-term, unsecured debt of states and municipalities. Maturities of tax-exempt commercial paper generally range from 30 to 90 days, though maturities of up to 270 days are possible.

Since commercial paper issuers generally allow investors to choose from a span of maturities, some paper is maturing almost every day and therefore must be replaced with new paper on an almost daily basis. The frequent involvement of issuers and their agents in the market is costly. Because of this cost, states and municipalities do not find it attractive to issue commercial paper unless they are borrowing at least $15 million to $25 million.

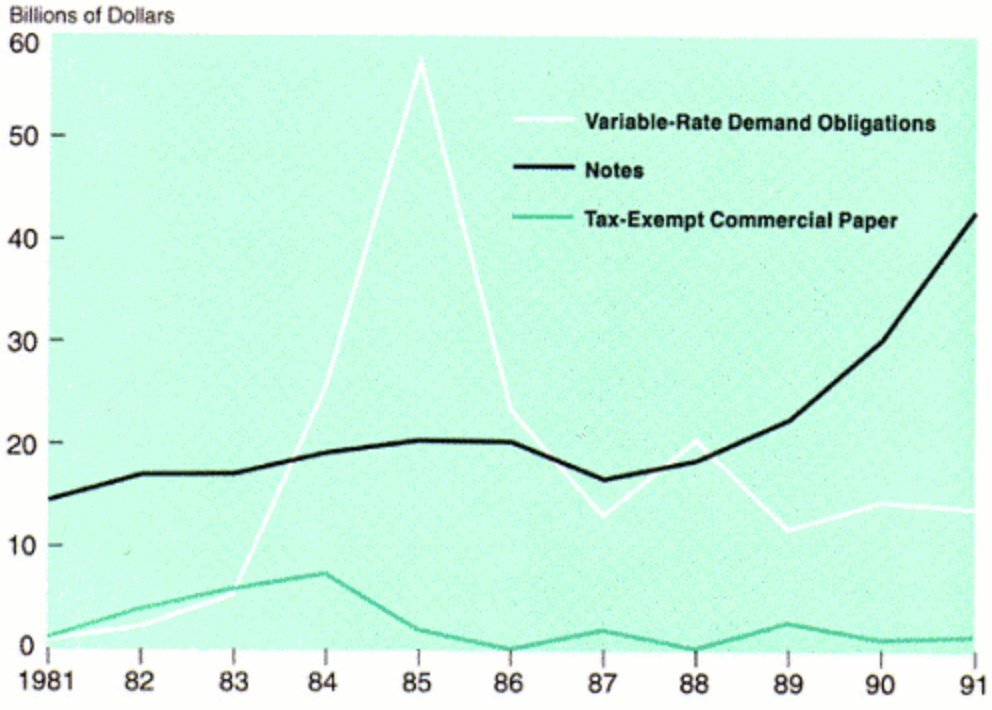
States and municipalities can continue rolling over maturing commercial paper as long as they need to borrow funds, so it can be used to fund long-term projects. For example, one state used a commercial paper program throughout the 1980s to finance its capital projects. The amount outstanding in the program was authorized by the state government to be as much as $90 million but the actual amount issued varied with funding demands. Denominations ranged between $50,000 and $5 million with the securities typically sold in $1 million lots. Maturities were between 3 days and 210 days depending upon investors' desires. Most of the commercial paper was purchased by money market funds.

Variable-rate demand (or put) obligations come in almost as many variations as there are dealers in the tax-exempt money market, but they share two

FIGURE 1

Short-Term Municipal Securities

New Issue Volume by Year



Note: Data for tax-exempt commercial paper for 1981-84 and data for notes and variable-rate demand obligations for 1981-1982 came from chart on page 1 of Standard & Poor's Credit Week—dated May 27, 1985. Other data came from Joe Kelley and Marc Katz at Securities Data Company.

characteristics.[4] First, they all feature periodic interest rate adjustments. Second, they include a demand option which gives the investor the right to tender the instrument to the issuer or a designated party on a specified number of days' notice at a price equal to the face amount plus accrued interest. The length of the notice period normally corresponds with the length of the period between interest rate adjustments. For example, if the interest rate is adjusted on a weekly basis, the variable-rate security will generally have a seven-day notice period. If the investor judges the current rate to be too low or if he wants his money back for some other reason, he exercises his demand option. In this case the instrument is resold to another investor. Many variable-rate demand obligations also include a provision allowing the issuer, after properly notifying all holders and allowing

[4] The terms "demand" and "put" are used interchangeably in the municipal security market. In this chapter, "demand" is used.

them the opportunity to tender their holdings, to convert the obligation into a fixed-rate security with no demand feature.

The length of the notice period on a variable-rate demand obligation determines its effective maturity from the investor's point of view and therefore strongly affects the interest rate which must be paid on the instrument. The most common notice periods are 1 day, 7 days, and 30 days. As a result of a fairly consistently upward-sloping yield curve in the municipal market, it is generally true that the shorter the notice period the lower the rate paid.

States and municipalities began to make significant use of tax-exempt commercial paper and variable-rate demand obligations in the early to mid-1980s. The tax-exempt yield curve became strongly upward-sloping in the early 1980s, which provided issuers with the incentive to rely more on short-term debt to meet their demand for long-term funding. Tax-exempt commercial paper and variable-rate demand obligations were favored because they have two advantages over notes as instruments for long-term funding. First, tax-exempt commercial paper and variable-rate demand obligations allow state and local finance departments to raise long-term funds without repeatedly bearing the costs associated with issuing and reissuing notes. These costs include legal fees and the costs of preparing official statements and seeking competitive bids (Peterson 1991, p. 305). Second, state or local finance departments generally must seek approval from voters or at least from elected officials before reissuing notes to replace maturing notes. This step is avoided when using tax-exempt commercial paper because finance departments employing tax-exempt commercial paper are given blanket authorization to issue and reissue as many units of the paper as necessary to provide a specified amount of funding for a specified period. Finance departments using variable-rate demand obligations also avoid having to repeatedly seek approval because variable-rate demand obligations can remain outstanding for long periods.

At the same time that the shape of the tax-exempt yield curve was encouraging states and municipalities to issue tax-exempt commercial paper and variable-rate demand obligations, the demand for these new instruments was greatly expanded by the rapid growth of tax-exempt money market funds. Like other money market funds, these funds wanted to maintain a constant value of $1 per share, so that investors would view their shares as close substitutes for deposits at commercial banks and other depository institutions. The desire to maintain a constant share value provided tax-exempt money market funds with the incentive to invest in securities with very short-term maturities because the market value of such securities does not fluctuate greatly with changes in market interest rates. This increased the demand by these funds for tax-exempt commercial paper and variable-rate demand obligations, which are generally offered with short maturities or short effective maturities. Their demand for these securities was reinforced by a 1983 Securities and Exchange Commission regulation requiring

that a fund wishing to use an accounting procedure that enables it to maintain a constant share value limit the average maturity of its portfolio to no more than 120 days. This was reduced to 90 days in 1991.

Variable-rate demand obligations have one important advantage over tax-exempt commercial paper for long-term borrowing. When commercial paper matures and is replaced with new commercial paper, the new security is legally defined as a new debt issue and is subject to the regulations in place at the time of its issue. Since Congress has been imposing limits on certain types of issues in recent years, issuers wishing to borrow for an extended period by using commercial paper face the danger of having a newly imposed or tightened limit eliminate their source of funds. Issuers of variable-rate demand obligations are not faced with this danger because when an investor exercises his demand option the securities are simply resold to another investor and new debt is not issued. This advantage may explain why states and municipalities issue much more variable-rate demand debt than tax-exempt commercial paper (Figure 1).

Money market funds are the major investor in both tax-exempt commercial paper and variable-rate demand obligations. Other investors include corporations, bank trust departments, and individuals. Since minimum denominations for both tax-exempt commercial paper and variable-rate demand obligations are fairly high, generally between $50,000 and $100,000 for tax-exempt commercial paper and between $5,000 and $100,000 for variable-rate demand obligations, individuals investing in these securities tend to be wealthy.

Swaps, Municipal Preferred Stock, and Floaters/Inverse Floaters Between the mid-1980s and 1990 investment bankers introduced three new products into the municipal market. Each of these, in effect, allows issuers to lock in fixed rates on long-term borrowings while giving investors variable rates.

The first of these new products, the swap, began to gain popularity in the municipal market in the mid-1980s. In general, a swap is an agreement between two parties to exchange interest payments for a fixed period of time. A municipal borrower wishing to lock in a fixed, long-term rate may be able to get a rate lower than the rate on conventional long-term municipal bonds by issuing a variable-rate demand obligation to an investor and entering into a swap agreement with a third party such as a commercial bank, investment bank, or insurance company. In the swap the municipal borrower pays the third party a fixed rate and receives a variable rate, which it in turn uses to pay the variable rate to the investor. Because the variable-rate payment made by the municipal issuer roughly cancels the variable-rate income it earns, the issuer ends up paying a fixed rate of interest for the term of the debt. As of the end of 1991, the notional value (the principal value of the securities yielding the interest payments that are swapped) of swaps outstanding in the municipal market was between $25 billion and $40 billion.

The second new product, municipal preferred stock, was introduced in 1988. Municipal preferred stock is an adjustable-rate obligation of a closed-end fund

that invests in fixed-rate, long-term municipal bonds.[5] Such a fund gathers part of its funding by selling the adjustable-rate municipal preferred stock and the rest by selling common stock. The rate on the preferred stock is reset in an auction. Some funds have auctions every 7 days and others every 28 days. Those wishing to purchase the preferred stock submit bids to the agent conducting the auction while those wishing to sell shares submit sell orders. The new rate on the preferred stock for the next 7 or 28 days is the rate that clears the market. An increase in the rate paid on the preferred stock lowers the value of the common stock because it reduces the share of interest income from the fixed-rate bonds going to the common stockholders. Approximately $6 billion of municipal preferred stock was outstanding as of January 1992.

The third new product, the floater/inverse floater, was first used in the municipal market in early 1990 and had grown to $2 billion by the end of 1991. When municipalities use this technique they issue equal dollar amounts of two types of securities, floaters and inverse floaters. The floaters earn an adjustable rate that is reset every 7 to 35 days based on an index rate or on the results of an auction of the securities. The inverse floaters earn an interest rate equal to a fixed rate of interest, which is set when the securities are initially issued, plus the difference between this fixed rate and the rate set on the floating-rate portion of the debt. If the rate paid on the floaters exceeds the fixed rate then the inverse floaters earn a rate lower than the fixed rate. Conversely, if the floating rate is below the fixed rate then the inverse floaters earn a rate above the fixed rate. The issuer pays a rate for the life of the instrument approximately equal to the fixed rate (the rate paid by the issuer may differ from the fixed rate on account of fees charged by the investment bankers). The holders of the floating-rate portion of the debt, who are generally corporations or individuals, get a variable-rate investment tied to the current short-term market rate. The holders of the inverse floating-rate portion, generally bond funds, receive a variable rate that moves in the opposite direction of the short-term market rate. Money market funds are prohibited by SEC regulation from holding floaters and inverse floaters.

Features of the commonly used short-term municipal instruments are summarized in Table 2.

THE INVESTMENT DECISION

An investor's decision whether to purchase a taxable or tax-exempt security depends largely on his marginal federal tax rate and the rates being paid on

[5] While mutual funds continuously buy and sell shares in their funds, the number of shares in closed-end funds is relatively fixed from the time the fund is initially offered. Stock in a closed-end fund is sold when the fund is formed and the fund generally does not sell additional shares or buy back its outstanding shares. The outstanding shares of a closed-end fund trade on an exchange or in an auction.

TABLE 2

Instruments Commonly Used in the Short-Term Municipal Market

Security Name	Types of Pledge	Features
NOTES		
Revenue Anticipation Note	G.O. or revenue	Fixed maturity of a few weeks to one year, fixed interest rates
Tax Anticipation Note	G.O. or revenue	Fixed maturity of a few weeks to one year, fixed interest rates
Grant Anticipation Note	G.O. or revenue	Fixed maturity of a few weeks to one year, fixed interest rates
Tax and Revenue Anticipation Note	G.O. or revenue	Fixed maturity of a few weeks to one year, fixed interest rates
Bond Anticipation Note	G.O. or revenue	Fixed maturity of a few weeks to one year, fixed interest rates
OTHER INSTRUMENTS		
Tax-Exempt Commercial Paper	G.O. or revenue; liquidity facility, credit facility	Maturities of a few days to 270 days depending on investor and issuer preference; interest rate fixed to maturity
Variable-Rate Demand Obligation	G.O. or revenue; liquidity facility, credit facility	May be tendered to issuer or designated party on a specified number of days' notice; floating or variable interest rate; many include features which allow conversion to a fixed rate
Swap	N/A	Financial agreement that trades a variable-rate interest payment stream for fixed-rate stream
Municipal Preferred Stock	N/A	Obligation of a closed-end, municipal bond fund; auction-determined, floating or variable interest rate
Floater/Inverse Floater	G.O. or revenue; credit facility	Floater pays market interest rate determined in weekly or monthly auctions; interest rate on inverse moves in opposite direction as floater, based on an equation

Note: G.O. denotes general obligation.

tax-exempts and taxables. Yields on tax-exempt securities are frequently stated in taxable equivalent terms, or in terms of what taxable interest rate would be necessary to provide the same after-tax interest rate. The basic taxable equivalent formula is

$$r_{TE} = r_{TF} / (1 - t), \quad (1)$$

where r_{TF} is the rate paid on the tax-free instrument and r_{TE} is the taxable equivalent yield for investors with a marginal federal tax rate of *t.* For example, if an investor subject to a 28 percent marginal federal tax rate purchases a tax-exempt security paying 5.4 percent, then a taxable security paying 7.5 percent would yield this investor the same after-tax rate as the tax-exempt security. If the investor's taxable equivalent yield on municipal securities is greater than the before-tax yields he can earn on taxable securities of comparable risk then he will profit by investing in tax-exempt securities.

The value of the tax exemption to the investor increases when the income earned also is exempt from state income tax. This is true for investors purchasing securities issued by their home state or by municipalities located in their home state. When the security is exempt from federal and state income taxes it is "double tax-exempt" for the investor and the relevant taxable equivalent formula is

$$r_{TE} = r_{TF} /\{ 1 - [t_F + t_S(1 - t_F)]\}, \quad (2)$$

where t_F is the marginal federal tax rate of the investor and t_S is the marginal state tax rate of the investor. This formula takes into account the deductibility of state income taxes on the federal return. Suppose an investor subject to a 28 percent federal tax rate has a 10 percent state income tax rate. The total tax rate faced by the individual is .28 + .10(1 - .28) = .35. If the municipal security being considered is exempt from state income taxes and is paying a 5.4 percent rate of return, then the taxable equivalent yield for this investor is 8.3 percent.[6]

Wealthy individuals and corporations are the largest investors in short-term tax-exempt municipal securities because they face the highest marginal rates and therefore earn the highest tax-equivalent yields on municipal securities. Some individuals invest in short-term municipal securities directly, either through a securities dealer or through a bank with a dealer department. But most individuals invest through tax-exempt money market funds. Corporations use short-term municipal investments mostly as a repository for their short-term or seasonal cash surpluses. Corporations invest directly in short-term municipal securities and indirectly through money market funds.

From equation (1) it can be seen that declines in federal tax rates would lower tax-equivalent yields on tax-exempt securities. Following a cut in tax rates, therefore, tax-exempt rates would have to increase relative to taxable rates in order to attract investors. Consequently, one would expect a cut in tax rates to lead to an increase in the ratio of tax-exempt to taxable yields.

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[6] The Tax Reform Act of 1986 makes the calculation of the taxable equivalent rate for municipal securities more complicated for some investors because it includes in its calculation of alternative minimum taxes interest income on private-activity debt issued after August 7, 1986.

TAX LEGISLATION AFFECTING THE YIELDS ON MUNICIPAL SECURITIES

Tax legislation in the 1980s reduced the relative attractiveness of municipal debt to many investors and as a result raised municipal rates relative to the rates on taxable instruments. Most importantly, federal income tax rates were lowered by a considerable margin in the 1980s. The Economic Recovery Tax Act of 1981 (ERTA) lowered the top individual tax rate from 70 percent to 50 percent and phased in a reduction of individual tax rates at lower income levels by 25 percent over three years. The Tax Reform Act of 1986 further reduced the top individual tax rate to 33 percent, lowered other individual tax rates, and also reduced the top corporate tax rate to 39 percent.

Legislation of the 1980s also greatly reduced the attractiveness to banks of investing in municipal securities. Prior to the 1980s, banks and other depository institutions were able to deduct from taxable income all their interest expenses incurred to fund holdings of municipal securities. The tax-deductible portion of banks' expense of carrying municipal securities was lowered to 85 percent by the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA) and then to 80 percent by the Deficit Reduction Act of 1984. Subsequently, the Tax Reform Act of 1986 totally eliminated the deductible portion of banks' expense of carrying municipal securities, with two exceptions.[7] Banks could continue to deduct 80 percent of the interest expense incurred in carrying debt purchased on or before August 7, 1986, and in carrying public-purpose debt of issuers that borrow no more than $10 million a year.

The steady erosion in the 1980s of the ability of banks to deduct from earnings the interest expenses incurred in carrying municipal debt led banks to reduce their investments in municipal securities and significantly diminished the importance of banks as purchasers of municipal securities. From 1980 to 1990 banks' holdings of municipal debt declined from 9.6 percent of their total assets to only 3.5 percent, and their share of total outstanding municipal debt fell from 42 percent to 11 percent.[8]

The decline in tax rates in the 1980s and the decreased demand by banks for municipal securities raised municipal rates relative to the rates on taxable instruments (Fortune 1991, p. 33; Peek and Wilcox 1986, pp. 35 and 38). This is illustrated in Figure 2, which graphs the ratio of the rate paid on one-year municipal notes to the rate on one-year Treasury bills.

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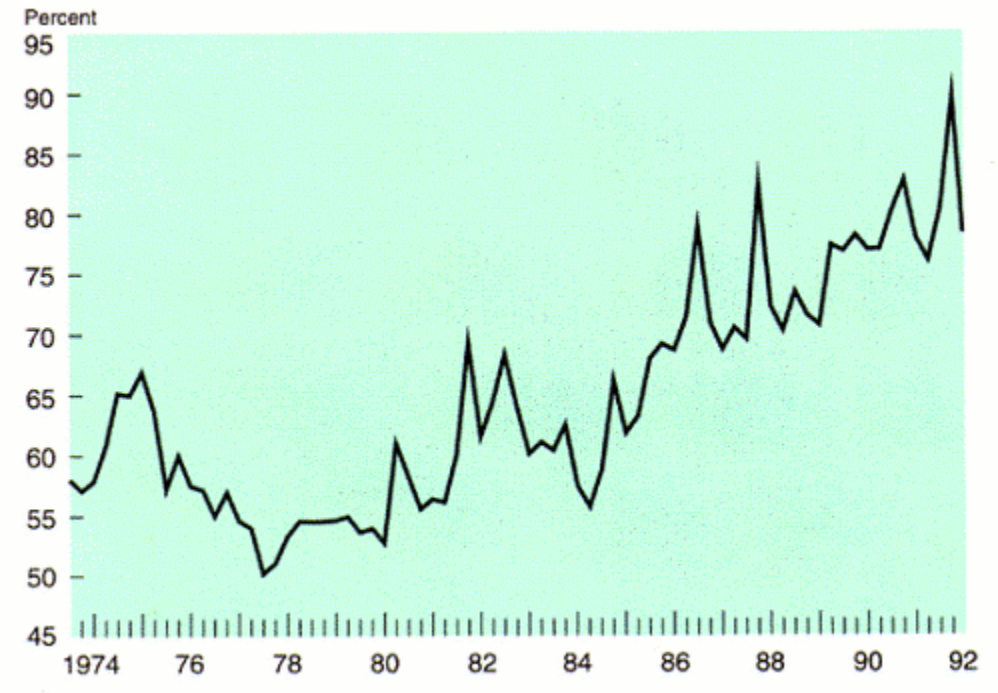
[7] The TEFRA, the Deficit Reduction Act of 1984, and the Tax Reform Act of 1986 all defined the interest expense of carrying tax-exempt obligations as the total interest expense of the financial institution times the proportion of all assets that are tax-exempt obligations.

[8] Data on municipal debt as a percentage of total bank assets are from Consolidated Reports of Condition and Income, December 31, 1980, and December 31, 1990. Figures on banks' share of municipal debt are from Board of Governors of the Federal Reserve System (1992).

FIGURE 2

Ratio of Rate on One-Year Municipal Note to

Rate on One-Year Treasury Bill



DEALERS

Most large banks and securities firms, along with some smaller firms specializing in municipal securities trading, act as dealers in the short-term municipal market. Municipal securities dealers underwrite and market new security issues and provide a secondary market for outstanding securities. Banks are limited by the Glass-Steagall Act of 1933 to underwriting only general obligation securities.

Security issues may be underwritten by one dealer if the issue is small or by a group of dealers, called a syndicate, if the issue is larger than one dealer would like to handle. In a syndicate one dealer acts as the lead dealer, taking the largest portion of securities and managing the sale of the issue. Syndicates are used to enlarge the number of possible investors and to spread the underwriting risk among dealers. The major risk is that interest rates may unexpectedly rise before the underwriter has sold the issue to the public, with the result that the security issue will not sell at a price that will earn a profit.

States and municipalities may issue securities either through a private placement in which they sell the securities to a limited number of investors or through a public offering. If they choose a public offering they must decide whether to sell their securities by competitive bidding or by a negotiated sale. In competitive bidding the municipality advertises the issue and then sells it to the underwriting dealer or syndicate of dealers that offers the highest price. In a negotiated sale the municipality chooses one dealer or syndicate without soliciting bids from other firms. Municipal notes are most often sold by competitive bidding. Variable-rate municipal securities and floater/inverse floater issues are generally sold through negotiated deals, while tax-exempt commercial paper is always sold in this manner.

In a note issue the dealer's responsibility, or dealers' responsibility when a syndicate is involved, to the issuer is limited to the initial sale of the securities. For variable-rate, commercial paper, and floater/inverse floater issues dealers frequently take on additional responsibilities. When variable-rate obligations are used, the dealer or the lead dealer generally becomes the remarketing agent and has the responsibility of resetting the interest rate on adjustment dates and reselling any securities that are tendered by investors. When commercial paper is issued, the dealer or lead dealer sets the rates and sells new paper to replace maturing paper. In floater/inverse floater issues the dealer or lead dealer conducts the auctions where rates are set and the securities are bought and sold.

Due to the heterogeneous nature of municipal issues, there is not an active secondary market. Dealers generally will make a secondary market in the short-term securities they have sold. Several electronic services and daily publications keep dealers and other participants in the market informed about what securities are being offered and what rates are being paid.

Dealers wishing to sell particular issues are often matched by brokers with those wishing to buy the same issues. Brokers deal only with large volumes and charge a small fee for their services.

The Municipal Securities Rulemaking Board (MSRB) develops and updates regulations by which dealers, dealer banks, and brokers in the municipal market are to operate (Peterson 1976, pp. 44-45). These regulations are enforced by the SEC, the federal bank regulators, and the National Association of Securities Dealers.

PROVIDERS OF CREDIT AND LIQUIDITY ENHANCEMENTS

In order to improve the credit ratings and marketability of their securities, municipal issuers frequently enter credit or liquidity substitution agreements. A credit substitution agreement is a contract in which a third party agrees to pay the holder of a security if the issuer does not pay. Under this contract the security

holder has a claim against the promising party if the issuer defaults. A liquidity substitution agreement is a conditional promise made by a third party either to purchase maturing or tendered securities itself or to provide the municipal issuer or its agent with a loan that will enable it to redeem the securities. A liquidity substitution agreement is activated when the remarketing agent cannot reissue the maturing securities or resell the tendered securities at an interest rate below some maximum set by the issuer or when it cannot resell them at all. Liquidity substitution agreements are conditioned on the financial health of the issuer. They generally have a clause that voids the agreement if the financial condition of the issuer deteriorates significantly.

Banks are the most common providers of credit substitution agreements in the short-term municipal market. Banks provide the agreements, for fees, by means of letters of credit or standby note or bond purchase agreements. Insurance companies provide the same type of promise through municipal bond insurance.

Issuers of municipal debt purchase credit substitution agreements to raise their credit ratings. One reason for doing so is that tax-exempt money market mutual funds limit their investments to municipal debt with top credit ratings. To sell their securities to money market funds, issuers with less than top ratings improve their ratings by obtaining a credit substitution promise.

Most liquidity substitution agreements are provided by large U.S. and foreign banks through lines of credit. Variable-rate demand obligations and commercial paper issues almost always require such agreements. Variable-rate demand obligations require liquidity substitution backing because of the danger that the holders of the securities will exercise their demand options at a time and in sufficient numbers that the remarketing agent will not be able to resell the securities and the issuer will not have sufficient funds in reserve to redeem them. Institutional investors, the biggest purchasers of such securities, require that this risk be covered. Similarly, there is some danger that when existing commercial paper matures the issuer's marketing agent will be unable to sell new paper and the issuer will not have sufficient funds to redeem it. Issuers of commercial paper must back their issues with liquidity facilities to assure investors that funds will be immediately available at maturity. Notes, municipal preferred stock, floater/inverse floater issues, and swaps typically do not require liquidity promises.

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Chapter 9
COMMERCIAL PAPER

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Commercial paper is a short-term unsecured promissory note issued by corporations and foreign governments. For many large, creditworthy issuers, commercial paper is a low-cost alternative to bank loans. Issuers are able to efficiently raise large amounts of funds quickly and without expensive Securities and Exchange Commission (SEC) registration by selling paper, either directly or through independent dealers, to a large and varied pool of institutional buyers. Investors in commercial paper earn competitive, market-determined yields in notes whose maturity and amounts can be tailored to their specific needs.

Because of the advantages of commercial paper for both investors and issuers, commercial paper has become one of America's most important debt markets. Commercial paper outstanding grew at an annual rate of 14 percent from 1970 to 1991. Figure 1 shows commercial paper outstanding, which totaled $528 billion at the end of 1991.

This chapter describes some of the important features of the commercial paper market. The first section reviews the characteristics of commercial paper. The second section describes the major participants in the market, including the issuers, investors, and dealers. The third section discusses the risks faced by investors in the commercial paper market along with the mechanisms that are used to control these risks. The fourth section discusses some recent innovations, including asset-backed commercial paper, the use of swaps in commercial paper financing strategies, and the international commercial paper markets.

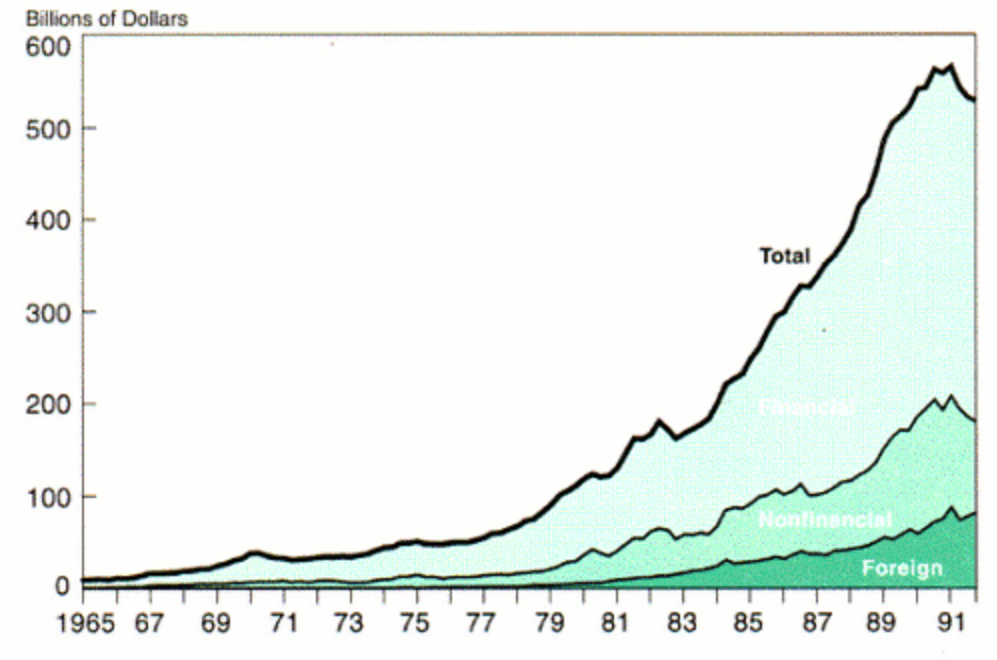
CHARACTERISTICS OF COMMERCIAL PAPER

The Securities Act of 1933 requires that securities offered to the public be registered with the Securities and Exchange Commission. Registration requires extensive public disclosure, including issuing a prospectus on the offering, and is a time-consuming and expensive process.[1] Most commercial paper is issued

[1] Registration for short-term securities is especially expensive because the registration fee is a percent of the face amount at each offering. Thirty-day registered notes, rolled over monthly for one year, would cost 12 times as much as a one-time issuance of an equal amount of one-year notes.

FIGURE 1

Commercial Paper Outstanding



Source: Board of Governors of the Federal Reserve System.

under Section 3(a)(3) of the 1933 Act which exempts from registration requirements short-term securities as long as they have certain characteristics.[2] The exemption requirements have been a factor shaping the characteristics of the commercial paper market.

One requirement for exemption is that the maturity of commercial paper must be less than 270 days. In practice, most commercial paper has a maturity of between 5 and 45 days, with 30-35 days being the average maturity. Many issuers continuously roll over their commercial paper, financing a more-or-less constant amount of their assets using commercial paper. Continuous rollover of notes does not violate the nine-month maturity limit as long as the rollover is not automatic but is at the discretion of the issuer and the dealer. Many issuers will adjust the maturity of commercial paper to suit the requirements of an investor.

[2] Some commercial paper is issued under one of the two other exemptions to the Securities Act. Commercial paper which is guaranteed by a bank through a letter of credit is exempt under Section 3(a)(2) regardless of whether or not the issue is also exempt under Section 3(a)(3). Commercial paper sold through private placements is exempt under Section 4(2). See Felix (1987) for more information on the legal aspects of commercial paper issuance.

A second requirement for exemption is that notes must be of a type not ordinarily purchased by the general public. In practice, the denomination of commercial paper is large: minimum denominations are usually $100,000, although face amounts as low as $10,000 are available from some issuers. Because most investors are institutions, typical face amounts are in multiples of $1 million. Issuers will usually sell an investor the specific amount of commercial paper needed.

A third requirement for exemption is that proceeds from commercial paper issues be used to finance "current transactions," which include the funding of operating expenses and the funding of current assets such as receivables and inventories. Proceeds cannot be used to finance fixed assets, such as plant and equipment, on a permanent basis. The SEC has generally interpreted the current transaction requirement broadly, approving a variety of short-term uses for commercial paper proceeds. Proceeds are not traced directly from issue to use, so firms are required to show only that they have a sufficient "current transaction" capacity to justify the size of the commercial paper program (for example, a particular level of receivables or inventory).[3] Firms are allowed to finance construction as long as the commercial paper financing is temporary and to be paid off shortly after completion of construction with long-term funding through a bond issue, bank loan, or internally generated cash flow.[4]

Like Treasury bills, commercial paper is typically a discount security: the investor purchases notes at less than face value and receives the face value at maturity. The difference between the purchase price and the face value, called the discount, is the interest received on the investment. Occasionally, investors request that paper be issued as an interest-bearing note. The investor pays the face value and, at maturity, receives the face value and accrued interest. All commercial paper interest rates are quoted on a discount basis.[5]

Until the 1980s, most commercial paper was issued in physical form in which the obligation of the issuer to pay the face amount at maturity is recorded by printed certificates that are issued to the investor in exchange for funds. The certificates are held, usually by a safekeeping agent hired by the investor, until

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[3] Some SEC interpretations of the current transaction requirement have been established in "no-action" letters. "No-action" letters, issued by the staff of the SEC at the request of issuers, confirm that the staff will not request any legal action concerning an unregistered issue. See Felix (1987, p. 39).

[4] Past SEC interpretations of Section 3(a)(3) exemptions have also required that commercial paper be of "prime quality" and be discountable at a Federal Reserve Bank (Release No. 33-4412). The discounting requirement was dropped in 1980. An increased amount of commercial paper in the later 1980s was issued without prime ratings.

[5] The Federal Reserve publishes in its H.15 statistical release daily interest rates for dealer-offered and directly placed commercial paper of one-month, three-month and six-month maturities. All rates are based on paper with relatively low default risk. Commercial paper rates of various maturities for select finance issuers and a dealer composite rate are also published daily in *The Wall Street Journal*.

presented for payment at maturity. The exchanges of funds for commercial paper first at issuance and then at redemption, called "settling" of the transaction, occur in one day. On the day the commercial paper is issued and sold, the investor receives and pays for the notes and the issuer receives the proceeds. On the day of maturity, the investor presents the notes and receives payment. Commercial banks, in their role as issuing, paying, and clearing agents, facilitate the settling of commercial paper by carrying out the exchanges between issuer, investor, and dealer required to transfer commercial paper for funds.

An increasing amount of commercial paper is being issued in book-entry form in which the physical commercial paper certificates are replaced by entries in computerized accounts. Book-entry systems will eventually completely replace the physical printing and delivery of notes. The Depository Trust Company (DTC), a clearing cooperative operated by member banks, began plans in September 1990 to convert most commercial paper transactions to book-entry form.[6] By May 1992, more than 40 percent of commercial paper was issued through the DTC in book-entry form.

The advantages of a paperless system are significant. The fees and costs associated with the book-entry system will, in the long run, be significantly less than under the physical delivery system. The expense of delivering and verifying certificates and the risks of messengers failing to deliver certificates on time will be eliminated. The problem of daylight overdrafts, which arise from nonsynchronous issuing and redeeming of commercial paper, will be reduced since all transactions between an issuing agent and a paying agent will be settled with a single end-of-day wire transaction.

MARKET PARTICIPANTS

Issuers and Uses of Commercial Paper Commercial paper is issued by a wide variety of domestic and foreign firms, including financial companies, banks, and industrial firms. Table 1 shows examples of the largest commercial paper issuers. Figure 2 shows outstanding commercial paper by type of issuer. The biggest issuers in the financial firm category in Figure 2 are finance companies. Finance companies provide consumers with home loans, retail automobile loans, and unsecured personal loans. They provide businesses with a variety of short- and medium-term loans including secured loans to finance purchases of equipment for resale. Some finance companies are wholly owned subsidiaries of industrial firms that provide financing for purchases of the parent firm's products. For example, a major activity of General Motors Acceptance Corporation (GMAC)

[6] See The Depository Trust Company (1990).

TABLE 1

Commercial Paper Outstanding by Major Issuer

Billions of Dollars

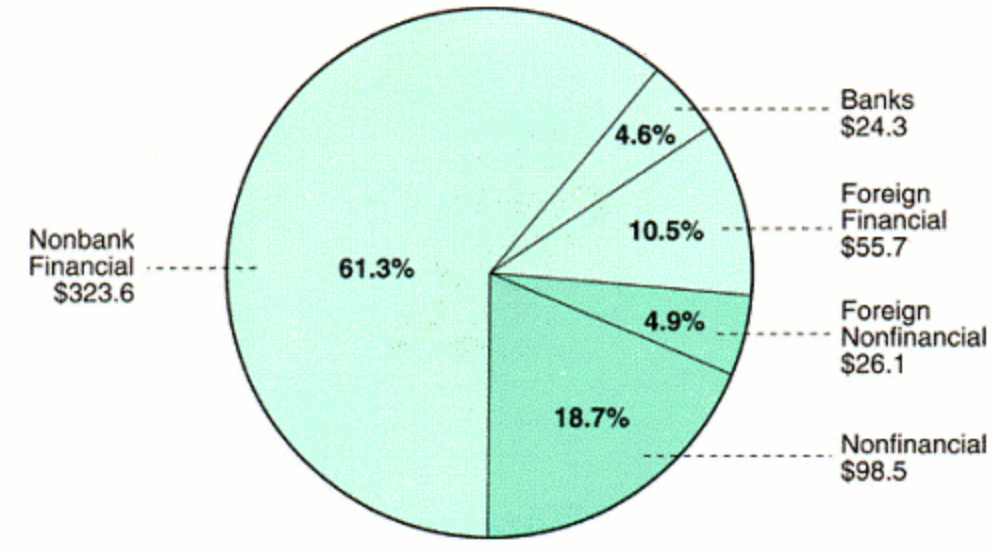
Category	Major Issuer	Average Amount Outstanding	Dealer
Finance	General Electric Capital (subsidiary of GE)	$36.9	Direct, Multiple
Auto Finance	General Motors Acceptance (subsidiary of GM)	$23.6	Direct
Investment Banking	Merrill Lynch	$ 7.5	Dealer is subsidiary
Commercial Banking	J.P. Morgan	$ 4.4	Multiple
Industrial	PepsiCo	$ 3.4	Multiple
Foreign	Hanson Finance	$ 3.5	Multiple
Asset-Backed	Corporate Asset Funding	$ 5.3	Goldman Sachs

Note: Quarterly Average Commercial Paper is for the first quarter of 1992, except GE, GMAC, and PepsiCo, which are for the fourth quarter of 1991.
Source: *Moody's Global Short-Term Record,* June 1992.

FIGURE 2: Commercial Paper Oustanding by Issuer Type

End of 1991 Total $528.1 Billion

Billions of Dollars



Source: Board of Governors of the Federal Reserve System.

is the financing of purchases and leases of General Motor's vehicles by dealers and consumers. The three largest issuers—GMAC, General Electric Capital, and Ford Motor Credit—accounted for more than 20 percent of the total nonbank financial paper outstanding at the end of 1991.

The financial issuer category also includes insurance firms and securities firms. Insurance companies issue commercial paper to finance premium receivables and operating expenses. Securities firms issue commercial paper as a low-cost alternative to other short-term borrowings such as repurchase agreements and bank loans, and they use commercial paper proceeds to finance a variety of security broker and investment banking activities.

Commercial bank holding companies issue commercial paper to finance operating expenses and various nonbank activities. Bank holding companies have recently decreased their commercial paper issues following declines in the perceived creditworthiness of many major domestic bank issuers.

More than 500 nonfinancial firms also issue commercial paper. Nonfinancial issuers include public utilities, industrial and service companies. Industrial and service companies use commercial paper to finance working capital (accounts receivable and inventory) on a permanent or seasonal basis, to fund operating expenses, and to finance, on a temporary basis, construction projects. Public utilities also use commercial paper to fund nuclear fuels and construction. Figure 3 shows that commercial paper as a percent of commercial paper and bank loans for nonfinancial firms rose from just 2 percent in 1966 to over 15 percent at the end of 1991.

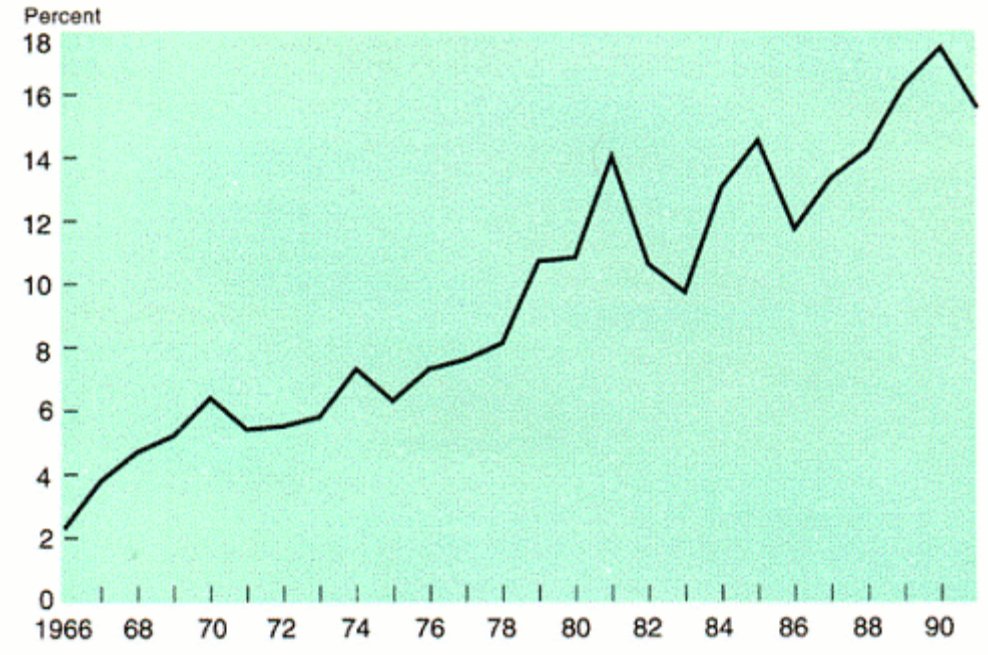
The domestic commercial paper issuers discussed above include U.S. subsidiaries of foreign companies. Foreign corporations and governments also issue commercial paper in the U.S. without use of a domestic subsidiary and these foreign issues have gained increased acceptance by U.S. investors. Foreign financial firms, including banks and bank holding companies, issue almost 70 percent of foreign commercial paper (Federal Reserve Bank of New York 1992). Industrial firms and governments issue the remainder. Japan, the United Kingdom, and France are among the countries with a significant number of issuers.

Investors Money market mutual funds (MMFs) and commercial bank trust departments are the major investors in commercial paper. MMFs hold about one-third of the outstanding commercial paper, while bank trust departments hold between 15 and 25 percent.[7] Other important investors, holding between 5 and 15 percent, are nonfinancial corporations, life insurance companies, and private and government pension funds. Other mutual funds, securities dealers,

[7]Precise data on holdings of commercial paper by investor type, except by MMFs, are not available. Some estimates are provided in Board of Governors of the Federal Reserve System (1992, p. 52), Stigum (1990, p. 1027), and Felix (1987, p. 13).

FIGURE 3

Commercial Paper as a Percent of Commercial Paper and Bank Loans, Nonfinancial Firms



Source: Board of Governors of the Federal Reserve System.

and banks also hold small amounts of commercial paper. Individuals hold little commercial paper directly because of the large minimum denominations, but they are large indirect investors in commercial paper through MMFs and trusts.

There have been major shifts in ownership of commercial paper during the post-World War II period. Prior to World War II, the most important investors in commercial paper were banks, which used commercial paper as a reserve asset and to diversify their securities portfolios. In the fifties and sixties, industrial firms began to hold commercial paper as an alternative to bank deposits, which had regulated interest rates that at times were significantly below the market-determined rates on commercial paper. Historically high and variable interest rates during the 1970s led households and businesses to hold more of their funds in short-term assets and to transfer funds from bank deposits with regulated interest rates to assets like MMF shares with market-determined rates. At the same time, many large businesses found that they could borrow in the commercial paper market at less expense than they could borrow from banks. MMFs demanded the

TABLE 2

Money Market Mutual Funds and Commercial Paper

Year-End	MMF Assets ($ billions)	Commercial Paper Outstanding ($ billions)	MMF Holdings of CP ($ billions)	CP as Percent of MMF Assets	Percent of CP Held by MMFs
1975	3.7	47.7	0.4	11	1
1980	74.5	121.6	25.0	33	21
1985	207.5	293.9	87.6	42	30
1990	414.8	557.8	199.1	48	36
1991	449.7	528.1	187.6	42	36

Note: MMFs exclude tax-exempt funds.
Source: Board of Governors of the Federal Reserve System.

short-term, large-denomination, relatively safe, and high-yield characteristics offered by commercial paper and hence absorbed a major portion of new commercial paper issues. Table 2 shows that both the commercial paper market and MMFs have experienced very rapid growth since 1975. By the end of 1991, MMFs held 36 percent of the commercial paper outstanding and commercial paper composed 42 percent of their total assets.

Placement and Role of the Dealer Most firms place their paper through dealers who, acting as principals, purchase commercial paper from issuers and resell it to the public. Most dealers are subsidiaries of investment banks or commercial bank holding companies. A select group of very large, active issuers, called direct issuers, employ their own sales forces to distribute their paper. There are approximately 125 direct issuers, most of which are finance companies or bank holding companies. These issuers sell significant amounts of commercial paper on a continuous basis.

When an issuer places its commercial paper through a dealer, the issuer decides how much paper it will issue at each maturity. The dealer is the issuer's contact with investors and provides the issuer with relevant information on market conditions and investor demand. Dealers generally immediately resell commercial paper purchased from issuers and do not hold significant amounts of commercial paper in inventory. Dealers will temporarily hold commercial paper in inventory as a service to issuers, such as to meet an immediate need for a significant amount of funds at a particular maturity.

The difference between what the dealer pays the issuer for commercial paper and what he sells it for, the "dealer spread," is around 10 basis points on an annual basis. A large commercial paper program with $500 million in paper outstanding for one year would cost the issuer $500,000 in dealer fees.

Because independent dealers are relatively inexpensive, only large and well-recognized issuers distribute their own commercial paper. Direct issuers are typically committed to borrowing $1 billion or more in the commercial paper market on a continuous basis (Felix 1987, p. 20). Partly as a result of the decline in dealer spreads over the last ten years, the percentage of total commercial paper issued directly fell from almost 55 percent in 1980 to just 35 percent at the end of 1991. An additional factor in the growth of dealer-placed commercial paper has been the entry into the market of smaller issuers who do not have borrowing needs large enough to justify a direct sales force.

Competition among dealers significantly increased in the late 1980s after the entrance into the market of bank dealers, which are subsidiaries of bank holding companies. Prior to the mid-1980s, commercial banks mainly acted as agents who placed commercial paper without underwriting and who carried out the physical transactions required in commercial paper programs, including the issuing and safekeeping of notes and the paying of investors at maturity. Bank dealers entered the market after legal restrictions on underwriting by bank holding companies were relaxed, and the increased competition led to declines in profit margins and the exit from the market of some major investment bank dealers. Salomon Brothers closed its dealership and Paine Webber sold its dealership to CitiCorp. Goldman Sachs, another important dealer, responded to increased competition by rescinding its longstanding requirement that it be the sole dealer for an issuer's commercial paper. Issuers have increased their use of multiple dealers for large commercial paper programs, frequently including a bank dealer in their team of dealers.

The largest commercial paper dealers are still the investment banks, including Merrill Lynch, Goldman Sachs, and Shearson Lehman. Commercial bank holding companies with large commercial paper dealer subsidiaries include Bankers Trust, CitiCorp, BankAmerica, and J.P. Morgan. Some foreign investment and commercial bank holding companies have also become significant dealers.

The secondary market in commercial paper is small. Partly the lack of a secondary market reflects the heterogeneous characteristics of commercial paper, which makes it difficult to assemble blocks of paper large enough to facilitate secondary trading. Partly it reflects the short maturity of the paper: investors know how long they want to invest cash and, barring some unforseen cash need, hold commercial paper to maturity. Dealers will sometimes purchase paper from issuers or investors, hold the paper in inventory and subsequently trade it. Bids for commercial paper of the largest issuers are available through brokers.

Some direct issuers offer master note agreements which allow investors, usually bank trust departments, to lend funds on demand on a daily basis at a rate tied to the commercial paper rate. Each day the issuer tells the investor the rate on the master note and the investor tells the issuer how much it will deposit that day. At the end of 1991, approximately 10 percent of GMAC's short-term notes

outstanding were master notes sold to bank trust departments (GMAC 1992, p. 13).

RISK IN THE COMMERCIAL PAPER MARKET

Ratings Since 1970, when the Penn Central Transportation Co. defaulted with $82 million of commercial paper outstanding, almost all commercial paper has carried ratings from one or more rating agency. Currently, the four major rating agencies are Moody's, Standard & Poor's, Duff & Phelps, and Fitch. An issuer's commercial paper rating is an independent "assessment of the likelihood of timely payment of [short-term] debt" (Standard & Poor's 1991, p. iii). Table 3 lists the four rating agencies, the rating scales they publish, and the approximate number of commercial paper ratings issued at the end of 1990. The ratings are relative, allowing the investor to compare the risks across issues. For example, Standard & Poor's gives an A-1 rating to issues that it believes have a "strong" degree of safety for timely repayment of debt, an A-2 rating to issues that it believes have a degree of safety that is "satisfactory," and an A-3 rating to issues that it believes have a degree of safety that is "adequate." Below these

TABLE 3

Rating Agencies and Commercial Paper Ratings

	Higher A/Prime	Lower A/Prime	Speculative Below Prime	Defaulted	Approx. # of CP Ratings	Major Publication Listing CP Ratings
Moody's	P-1	P-2, P-3	NP	NP	2,000	Moody's Global Short-Term Market Record
Standard & Poor's	A-1+, A-1	A-2, A-3	B, C	D	2,000	S&P Commercial Paper Ratings Guide
Duff & Phelps	Duff 1+, Duff 1, Duff 1-	Duff 2, Duff 3	Duff 4	Duff 5	175	Short-Term Ratings and Research Guide
Fitch	F-1+, F-1	F-2, F-3	F-5	D	125	Fitch Ratings
Range of Likely S&P Long-Term Bond Rating	AAA, AA, A	A, BBB	BB, B, CCC, CC, C			

three categories are the speculative grades in which the capacity for repayment is small relative to the higher-rated issues. Finally, a D rating indicates the issuer has defaulted on its commercial paper. Almost all issuers carry one of the two highest Prime or A ratings.

Issuers hire the rating agencies to rate their short-term debt and pay the agencies an annual fee ranging from $10,000 to $29,000 per year. For an additional fee the agencies will also rate other liabilities of the issuer, including their long-term bonds. The ratings are provided to the public, generally by subscription, either through publications, computer databases, or over the phone. Major announcements by the rating agencies are also reported on news wire services. Table 3 lists each agency's major publication in which commercial paper ratings appear.

Rating agencies rely on a wide variety of information in assessing the default risk of an issuer. The analysis is largely based on the firm's historical and projected operating results and its financial structure. Relevant characteristics include size (both absolute and compared to competitors), profitability (including the level and variation of profits), and leverage. Table 4 shows the means of selected historical characteristics of a sample of publicly traded nonfinancial issuers by commercial paper rating category. The table shows that higher-rated issuers are on average more profitable than lower-rated issuers and, with some exceptions, larger. Additionally, higher-rated issuers rely less heavily on debt financing than lower-rated issuers and have stronger interest-coverage and

TABLE 4

Characteristics of Industrial Commercial Paper Issuers by Rating, Three-Year Averages

Standard & Poor's Commercial Paper Rating	Number of Companies	Assets (millions)	Interest Coverage	Debt Coverage	Leverage	Profitability
A-1+	91	$4,547	8x	.7x	27%	18%
A-1	102	$2,924	5x	.5x	35%	16%
A-2	97	$1,866	4x	.4x	36%	14%
A-3	9	$5,252	2x	.2x	52%	10%

Notes: Sample consists of nonfinancial commercial paper issuers required to file with the SEC.
Interest coverage is defined as the ratio of income available for interest to interest expense. Income available for interest is defined as pre-tax income less special income plus interest expense.
Debt coverage is defined as the ratio of cash flow to short- and long-term debt. Cash flow is income plus preferred dividends plus deferred taxes.
Leverage is defined as the ratio of total debt to invested capital. Invested capital is the sum of short- and long-term debt, minority interest, preferred and common equity, and deferred taxes.
Profitability is defined as the ratio of income available for interest to invested capital.
Source: Standard & Poor's Compustat Services.

debt-coverage ratios.[8] In addition to evaluating the firm's operating results and financial structure, rating agencies also evaluate more subjective criteria like quality of management and industry characteristics. The same factors influence the issuer's short-term and long-term debt rating so there is generally a close correspondence between the commercial paper rating and the bond rating.

Ratings are crucially important in the commercial paper market. Ratings are useful as an independent evaluation of credit risk that summarizes available public information and reduces the duplication of analysis in a market with many investors (Wakeman 1981). Ratings are also used to guide investments in commercial paper. Some investors, either by regulation or choice, restrict their holdings to high-quality paper and the measure of quality used for these investment decisions is the rating. For example, regulations of MMFs limit their holdings of commercial paper rated less than A1-P1. Other market participants, including dealers and clearing agencies, also generally require issuers to maintain a certain quality. Again, credit quality is measured by the rating.

Backup Liquidity Commercial paper issuers maintain access to funds that can be used to pay off all or some of their maturing commercial paper and other short-term debt. These funds are either in the form of their own cash reserves or bank lines of credit. Rating agencies require evidence of short-term liquidity and will not issue a commercial paper rating without it. The highest-rated issuers can maintain liquidity backup of as little as 50 percent of commercial paper outstanding, but firms with less than a high A1-P1 rating generally have to maintain 100 percent backup.

Most commercial paper issuers maintain backup liquidity through bank lines of credit available in a variety of forms. Standard credit lines allow borrowing under a 90-day note. Swing lines provide funds on a day-to-day basis, allowing issuers to cover a shortfall in proceeds from paper issuance on a particular day. Increasingly, backup lines of credit are being structured as more secure multi-year revolver agreements in which a bank or syndicate of banks commit to loan funds to a firm on demand at a floating base rate that is tied to the prime rate, LIBOR rate, or certificate of deposit rate. The spread over the base rate is negotiated at the time the agreement is made and can either be fixed or dependent on the bond rating of the borrower at the time the loan is drawn down. The length of the revolver commitment varies, but the trend in revolvers has been towards shorter terms, typically around three years. As compensation for the revolver commitment, the firm pays various fees to the bank. The facility fee is a percentage of the credit line and is paid whether or not the line is activated. The commitment fee is a percentage of the unused credit line. This type of fee has

[8] Because ratings depend on historical operating results, researchers have had some success in predicting ratings based on accounting data. See, for example, Peavy and Edgar (1983).

become less common in recent years. A usage fee is sometimes charged if the credit line is heavily used.

Backup lines of credit are intended to provide funds to retire maturing commercial paper when an event prevents an issuer from rolling over the paper. Such an event may be specific to an issuer: an industrial accident, sudden liability exposure, or other adverse business conditions that investors perceive as significantly weakening the credit strength of the issuer. Or the event may be a general development affecting the commercial paper market. For instance, a major issuer might default, as Penn Central did in 1970, and make it prohibitively expensive for some issuers to roll over new paper, or a natural disaster such as a hurricane may interrupt the normal function of the market.

Backup lines of credit will generally not be useful for a firm whose operating and financial condition has deteriorated to the point where it is about to default on its short-term liabilities. Credit agreements frequently contain "material adverse change" clauses which allow banks to cancel credit lines if the financial condition of a firm significantly changes. Indeed, the recent history of commercial paper defaults has shown that as an issuer's financial condition deteriorates and its commercial paper cannot be rolled over, backup lines of credit are usually canceled before they can be used to pay off maturing commercial paper.

General factors affecting the commercial paper market may also result in the disruption of backup lines of credit. Standard & Poor's has emphasized this point in an evaluation of the benefits to investors of backup credit lines: "A general disruption of commercial paper markets would be a highly volatile scenario, under which most bank lines would represent unreliable claims on whatever cash would be made available through the banking system to support the market" (Samson and Bachmann 1990, p. 23). Part of the risk assumed by commercial paper investors is the possibility of this highly volatile scenario.

Credit Enhancements While backup lines of credit are needed to obtain a commercial paper rating, they will not raise the rating above the underlying creditworthiness of the issuer. Issuers can significantly increase the rating of their paper, however, by using one of a variety of credit enhancements which lower default risk by arranging for an alternative party to retire the commercial paper if the issuer cannot. These credit enhancements differ from backup lines of credit in that they provide a guarantee of support which cannot be withdrawn. Some smaller and riskier firms, which normally would find the commercial paper market unreceptive, access the commercial paper market using these enhancements.

Some large firms with strong credit ratings raise the ratings of smaller and less creditworthy subsidiaries by supporting their commercial paper with outright guarantees or with less secure "keepwell" agreements which describe the commitment the parent makes to assist the subsidiary to maintain a certain creditworthiness (Moody's, July 1992). Since parent companies may have incentives

to prevent default by their subsidiaries, the affiliation of a subsidiary with a strong parent can raise the credit rating of the subsidiary issuer.

Firms also raise their credit ratings by purchasing indemnity bonds from insurance companies or standby letters of credit sold by commercial banks. Both of these enhancements provide assurance that the supporting entity will retire maturing commercial paper if the issuer cannot. With a letter of credit, for example, the issuer pays a fee to the bank, attaches the letter of credit to the commercial paper and effectively rents the bank's rating. The attention of the rating agency and investors shift from the issuer to the supporting bank. The issue will generally receive the same rating as the bank's own commercial paper and offer an interest rate close to the bank's paper. Since relatively few U.S. banks have A1-P1 ratings, highly rated foreign banks are the primary sellers of commercial paper letters of credit. At the end of the first quarter of 1992, approximately 6 percent of commercial paper was fully backed by a credit enhancement, primarily bank letters of credit, issued by a third party unaffiliated with the issuer (Federal Reserve Bank of New York 1992).

Slovin et al. (1988) show that the announcement of a commercial paper program with a credit enhancement[9] has been associated with a significant increase in the value of the issuer's equity, but the announcement of a commercial paper program with no credit enhancement has no impact on firm value. This evidence suggests that by issuing a letter of credit and certifying the creditworthiness of the issuer, the commercial bank provides new information to the capital markets. These results provide support for the hypothesis that banks generate information relevant for assessing credit risk that the securities markets do not have. Banks supply this information to the capital market through commercial paper programs supported by letters of credit.

Default History and Yields Commercial paper pays a market-determined interest rate that is closely related to other market interest rates like the rate on large certificates of deposit. Because commercial paper has default risk, its yield is higher than the yield on Treasury bills. From 1967 through 1991, the spread of the one-month commercial paper rate over the one-month Treasury bill rate averaged 117 basis points.

Default risk also creates a differential between the rates on different quality grades of commercial paper. Figure 4 shows the spread between the yield on commercial paper rated A1-P1 and the yield on paper rated A2-P2. This spread averaged 52 basis points from 1974 through 1991. Default risk as measured by the quality spread shows some variation over time, rising during recessions and falling during expansions.

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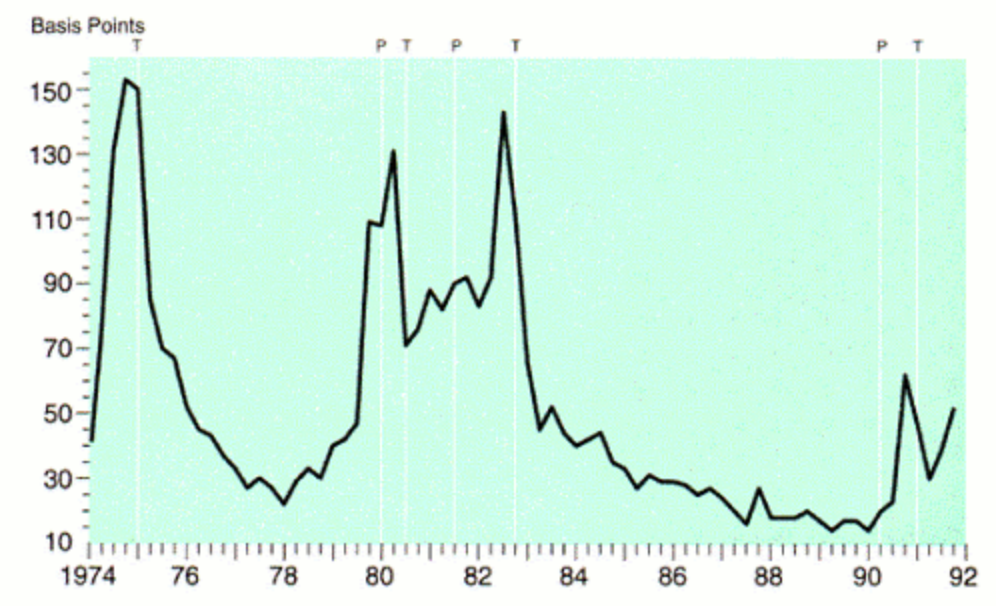
[9] The credit enhancements examined were standby letters of credit and, for programs outside the United States, note issuance facilities.

FIGURE 4

Spread Between the Rates on Prime- and Medium-Grade Commercial Paper



Source: Board of Governors of the Federal Reserve System.

Historically, the commercial paper market has been remarkably free of default. As shown in Table 5, in the 20-year period from 1969 through 1988 there were only two major defaults. The low default rates in the commercial paper market largely reflect the tastes of commercial paper investors. As shown in Table 4, investors typically prefer commercial paper issued by large firms with long track records, conservative financing strategies, and stable profitability. Most investors will not buy paper from small, unknown, highly leveraged issuers unless the paper has credit enhancements attached. Moreover, rating services will not assign a prime rating to these issues and most dealers will not distribute the paper.

Even a major issuer can find the commercial paper market unreceptive if its financial condition is perceived by the market to have weakened. Fons and Kimball (1992) estimate that issuers who defaulted on long-term debt withdrew from the commercial paper market an average of almost three years prior to default. As ratings declined, these issuers significantly decreased their commercial paper borrowings. Fons and Kimball (1992) take this "orderly exit" mechanism as evidence that investors in the commercial paper market are "unreceptive to lower-quality paper." Crabbe and Post (January 1992) document the orderly exit

TABLE 5

Major Defaults in the U.S. Commercial Paper Market

Issuer	Date of Default	Amount Outstanding at Default ($ millions)	Original Rating of Longest Outstanding Defaulting CP	
			Moody's	S&P
Penn Central	6/21/70	82.0	NR	NR
Manville Corp.	8/26/82	15.2	P-2	A-2
Integrated Resources	6/15/89	213.0	NR	A-2
Colorado Ute Electric	8/17/89	19.0	P-1	A-1
Equitable Lomas Leasing	9/12/89	53.0	P-3	A-3
Mortgage & Realty Trust	3/15/90	166.9	NR	A-2
Washington Bancorp	5/11/90	36.7	NR	NR
Stotler Group	7/25/90	0.8	NR	NR
Columbia Gas	6/12/91	268.0	P-2	A-2

Source: Fons and Kimball (1992), *Wall Street Journal, Dow Jones News Wire, Business Week,* Standard & Poor's.

mechanism using a sample of bank holding company issuers during 1986 to 1990. For issuers which experienced Moody's commercial paper rating downgrades, commercial paper outstanding declined on average by 12.2 percent in the ten weeks prior to the rating change and 15.7 percent in the first four weeks after the change.

The number of commercial paper defaults rose to seven in 1989 to 1991, but even in this period the default rate was low. Fons and Kimball (1992) estimate the dollar amount of defaults over this period as a percentage of the total volume issued.[10] They find that the default rate for the United States was only 0.0040 percent in 1989-91, which means that "an investor purchasing U.S.-issued commercial paper. . . throughout the 1989-1991 period experienced, on average, interruption in promised payments of roughly [40/100] of a penny for every $100 invested" (p. 13).

The rise in defaults in the 1989 to 1990 period may have partially reflected an increased tolerance for riskier paper in the later part of the 1980s. Unrated commercial paper grew significantly in the late 1980s to $5 billion in January 1990. Over the same period, the spread between the yields on A1-P1 paper and A2-P2 paper was unusually low (averaging less than 30 basis points). These developments were reversed in the early 1990s following the rise in commercial paper defaults, the deterioration in economic conditions, and the bankruptcy

[10] Fons and Kimball (1992) estimate the total volume of commercial paper issuance as average outstanding commercial paper times (365/average maturity). Average maturity is estimated at 30 days.

of Drexel Burnham, a major dealer and promoter of unrated commercial paper. By early 1991, unrated paper outstanding had fallen to below $1 billion and the A1-A2 spread had risen to almost 50 basis points, its highest level since 1982.

The commercial paper defaults in 1989 and 1990 had a significant impact on the demand for lower-rated paper by money market mutual funds. Several MMFs were major holders of defaulted paper of Integrated Resources and Mortgage & Realty Trust.[11] Following these defaults, some MMFs began to voluntarily restrict their commercial paper holdings to A1-P1 issues. Then in June 1991, SEC regulations became effective that limited MMFs to investing no more than 1 percent of their assets in any single A2-P2 issuer and no more than 5 percent of assets in A2-P2 paper. Previously, there had been no restriction on MMF total holding of A2-P2 paper, and MMFs had held approximately 10 percent of their assets in A2-P2 paper at the end of 1990. Crabbe and Post (May 1992) find that by the end of 1991, MMFs had reduced their holdings of A2-P2 commercial paper to almost zero. Along with the 1989 and 1990 defaults, they point to the June 1991 regulations as an important factor influencing MMF investment choices.

INNOVATIONS

Asset-Backed Commercial Paper A relatively new innovation in the commercial paper market is the backing of commercial paper with assets. The risk of most commercial paper depends on the entire firm's operating and financial risk. With asset-backed paper, the paper's risk is instead tied directly to the creditworthiness of specific financial assets, usually some form of receivable. Asset-backed paper is one way smaller, riskier firms can access the commercial paper market. The advantages of asset-backed securities have led large, lower-risk commercial paper issuers to also participate in asset-backed commercial paper programs. Asset-backed programs have grown rapidly since the first program in 1983. Standard & Poor's has rated more than 60 asset-backed issues (Kavanagh et al. 1992, p. 109) with an estimated $40 billion outstanding.

Asset-backed commercial paper is issued by a company, called a special purpose entity, which purchases receivables from one firm or a group of firms and finances the purchase with funds raised in the commercial paper market. The sole business activity of the special company is the purchase and finance of the receivables so the risk of the company and the commercial paper it issues is isolated from the risk of the firm or firms which originated the receivables.

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[11] Value Line's MMF, for example, held 3.5 percent of its portfolio in $22.6 million of Integrated's paper. Value Line protected the fund's investors, absorbing the loss at an after-tax cost of $7.5 million.

The trade receivables and credit card receivables that are typically used in asset-backed programs have a predictable cash flow and default rate so the risk of the assets can be estimated. Asset-backed paper programs are structured so that the amount of receivables exceeds the outstanding paper. In addition to this over-collaterization, credit enhancements are used, including guarantees by the firm selling the receivables, bank letters of credit, or surety bonds. As with all commercial paper issues, rating agencies require backup liquidity.

The combining of similar receivables from a group of companies into a pool large enough to justify a commercial paper program allows small firms to participate in asset-backed programs and serves to diversify some of the receivables' default risk. Typically, the financing firm which pools the receivables is managed by a commercial bank which purchases assets from its corporate clients.

Swaps A factor in the growth of the commercial paper market during the 1980s has been the rapid growth in the market for interest rate swaps. Interest rate swaps are one of a variety of relatively new instruments that have significantly increased the financing options of commercial paper issuers. Swaps provide issuers with flexibility to rapidly restructure their liabilities, to raise funds at reduced costs, and to hedge risks arising from short-term financing programs.

Interest rate swaps are agreements between two parties to exchange interest rate payments over some specified time period on a certain amount of unexchanged principle. To appreciate the role of swaps it is necessary to understand that there are two interest rate risks associated with commercial paper borrowing. First, the firm faces market interest rate risk: the risk that the rate it pays on commercial paper will rise because the level of market interest rates increases. A change in the risk-free rate, such as the Treasury bill rate, will cause a corresponding change in all commercial paper and borrowing rates. Second, the firm faces idiosyncratic interest rate risk: the risk that commercial paper investors will demand a higher rate because they perceive the firm's credit risk to have increased. With idiosyncratic risk, the rate on its commercial paper can rise without an increase in the risk-free rate or in other commercial paper rates.

A commercial paper issuer can eliminate market interest rate risk by entering into a swap and agreeing to exchange a fixed interest rate payment for a variable interest rate. For example, in the swap the firm may pay a fixed interest rate that is some spread over the multi-year Treasury bond rate and receive the floating six-month LIBOR rate. If the commercial paper rate rises because of a general rise in the market interest rate, the firm's increased interest payment on its commercial paper is offset by the increased payment it receives from the swap. This swap allows the firm to transform its short-term, variable-rate commercial paper financing into a fixed-rate liability that hedges market interest rate risks in the same manner as long-term fixed-rate, noncallable debt. Note that the firm still bears the risk of idiosyncratic changes in its commercial paper rate. If its own commercial paper rate rises while other rates, including the LIBOR rate, do not

rise, the cost of borrowing in the commercial paper market will rise without a corresponding increase in the payment from the swap.

Alternatively, the firm can fix the cost of its idiosyncratic risk by borrowing in the long-term market at a fixed rate and entering into a swap in which it pays a floating rate and receives a fixed rate. The swap effectively converts the long-term fixed-rate liability into a floating-rate liability that is similar to commercial paper. The firm now faces the risk of a general change in the level on interest rates, just like a financing strategy of issuing commercial paper, but has fixed the cost of its idiosyncratic risk by borrowing long-term in the bond market at a fixed-rate.

One important and unresolved issue is what the advantage of swaps are relative to alternative financing strategies. For example, why would a firm issue short-term debt and swap the flexible rate into a long-term rate instead of issuing long-term debt? Researchers have advanced a variety of hypotheses to explain the rapid growth of the interest rate swap market, but no real consensus has been reached. Many explanations view swaps as a way for firms to exploit differences in the premium for credit risk at different maturities and in different markets. For example, one firm may find it can issue commercial paper at a rate close to the average for similarly rated issuers but pays a significantly higher spread in the long-term fixed-rate market. If the firm prefers fixed-rate financing, a commercial paper program combined with a swap may provide cheaper financing than issuing fixed-rate debt. But it is uncertain what causes these borrowing differentials.[12]

The two interest rate swaps discussed above are the most basic examples of a wide variety of available swaps. The examples are constructed to highlight some important aspects of interest rate swaps, but it is not known how many of these swaps are currently being used in conjunction with commercial paper programs.[13] Some commercial paper programs involve international debt issues in conjunction with both interest rate and currency swaps.

Foreign Commercial Paper Markets While the U.S. market is by far the largest, a variety of foreign commercial paper markets began operating in the 1980s and early 1990s. Table 6 lists the international markets and shows estimates of paper outstanding at the end of 1990. Even though the U.S. commercial paper market continued to grow in the later 1980s, its share of the worldwide commercial paper market fell from almost 90 percent in 1986 to less than 65 percent in 1990. The Japanese market, which began in 1987, is the largest commercial paper market outside the United States. In Europe, the French, Spanish, and

[12] Some suggested reasons include market inefficiencies and differences in agency costs and bankruptcy costs across various forms of debt. Wall and Pringle (1988) provide a review of the uses and motivations for interest rate swaps.

[13] Einzig and Lange (1990) discuss some examples of interest rate swaps used in practice.

TABLE 6

International Commercial Paper Markets

Amounts Outstanding, End of 1990

Billions of U.S. Dollars

United States	557.8
Japan	117.3
France	31.0
Canada	26.8
Sweden	22.3
Spain	20.0 *
Australia	10.9
United Kingdom	9.1
Finland	8.3
Norway	2.6
Netherlands	2.0
Euro-CP	70.4
Total	878.5

* Estimate
Source: Bank for International Settlements.

Swedish commercial paper markets are well established and the German market has shown rapid growth since it began in 1991.[14]

Some U.S. firms simultaneously maintain a commercial paper program in the United States and issue dollar-denominated commercial paper abroad in the Euro commercial paper market. The Euro commercial paper market developed from note issuance and revolving underwriting facilities of the late 1970s in which firms issued tradable notes with the characteristics of commercial paper in conjunction with a loan agreement in which a bank or bank syndicate agreed to purchase the notes if the issuer was unable to place them with investors. In the early 1980s, higher-quality issuers began issuing notes without the backup facilities. The Euro commercial paper market grew rapidly from 1985 to 1990. By the middle of 1992, outstanding Euro commercial paper totaled $87 billion. U.S. financial and industrial firms are important issuers, either directly or through their foreign subsidiaries. Approximately 75 percent of Euro commercial paper is denominated in U.S. dollars while the remainder is denominated in European currency units, Italian liras, and Japanese yen. Issuers commonly issue Euro commercial paper in dollars and use swaps or foreign exchange transactions to convert their borrowings to another currency. The foreign markets, including the Euro commercial paper market, provide issuers flexibility in raising

[14] Bank for International Settlements (1991) reviews the international commercial paper markets. Also see Euromoney (1992) for a review of the European money markets.

short-term funds, allowing them to diversify their investor base, to establish presence in the international credit markets, and to obtain the lowest cost of funds.

While the Euro commercial paper market has similarities to the U.S. market, there are some important differences. The maturity of Euro commercial paper has been longer than in the United States, typically between 60 to 180 days, and, partly reflecting the longer maturities, there is an active secondary market. There is some evidence that the credit quality of the typical issuer in the Euro commercial paper market is not as high as in the U.S. market. Both Standard & Poor's and Moody's rate Euro commercial paper programs, but ratings have not been as crucial in the Euro market as they have been in the U.S. market. U.S. firms with less than A1-P1 ratings have found that the Euro market has been more receptive than the domestic market to commercial paper issues with no credit enhancements attached. Higher default rates abroad reflect the less stringent credit standards. Fons and Kimball (1992) estimate that the amount of defaults as a percent of the total volume of commercial paper issued in the non-U.S. markets (including the Euro commercial paper market) in 1989 to 1991 was 0.0242 percent, which was significantly greater than the 0.0040 percent in the U.S. market. In 1989, the four Euro commercial paper defaults affected almost 1 percent of the market.

The Growing Importance of Commercial Paper The rapid growth of commercial paper shown in Figure 1 reflects the advantages of financing and investing using the capital markets rather than the banking system. To a significant extent, the advantage of commercial paper issuance is cost: high-quality issuers have generally found borrowing in the commercial paper to be cheaper than bank loans. The cost of commercial paper programs, including the cost of distribution, agent fees, rating fees, and fees for backup credit lines, are small, amounting to perhaps 15 basis points in a large program. A highly rated bank borrows at a cost of funds comparable to other commercial paper issuers, and it must add a spread when lending to cover the expenses and capital cost of its operations and to cover any reserve requirements. Riskier firms are willing to pay this spread because the bank adds value by generating information about the creditworthiness of the borrower which enables it to lend at less cost than the commercial paper market. A large creditworthy issuer will generally find it cheaper to bypass the bank and raise funds directly in the credit market.

The growth of the commercial paper market can be viewed as part of a wider trend towards corporate financing using securities rather than bank loans. Other aspects of this trend, commonly referred to as asset securitization, include the rapid growth of the bond and junk bond markets and the market for asset-backed securities. The pace of asset securitization increased sharply in the 1980s. New security technology, including the development of risk management tools like

swaps and interest rate caps, became widespread. At the same time, established markets expanded to include new issuers. Smaller, riskier firms increased their issuance of long-term bonds and entered the commercial paper market with asset-backed paper and letter of credit programs. Commercial paper is likely to remain a significant source of financing for domestic and foreign firms and a relatively safe short-term security for investors.

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The information in this chapter was last updated in 1993. Since the money market evolves very rapidly, recent developments may have superseded some of the content of this chapter.

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Chapter 10
BANKERS ACCEPTANCES
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A bankers acceptance, or BA, is a time draft drawn on and accepted by a bank. Before acceptance, the draft is not an obligation of the bank; it is merely an order by the drawer to the bank to pay a specified sum of money on a specified date to a named person or to the bearer of the draft. Upon acceptance, which occurs when an authorized bank employee stamps the draft "accepted" and signs it, the draft becomes a primary and unconditional liability of the bank. If the bank is well known and enjoys a good reputation, the accepted draft may be readily sold in an active market.

THE CREATION OF A BANKERS ACCEPTANCE

Acceptances arise most often in connection with international trade: U.S. imports and exports and trade between foreign countries.[1] An American importer may request acceptance financing from its bank when, as is frequently the case in international trade, it does not have a close relationship with and cannot obtain financing from the exporter it is dealing with. Once the importer and bank have completed an acceptance agreement, in which the bank agrees to accept drafts for the importer and the importer agrees to repay any drafts the bank accepts, the importer draws a time draft on the bank. The bank accepts the draft and discounts it; that is, it gives the importer cash for the draft but gives it an amount less than the face value of the draft. The importer uses the proceeds to pay the exporter.

The bank may hold the acceptance in its portfolio or it may sell, or rediscount, it in the secondary market. In the former case, the bank is making a loan to the importer; in the latter case, it is in effect substituting its credit for that of the importer, enabling the importer to borrow in the money market. On or before the maturity date, the importer pays the bank the face value of the acceptance. If the bank rediscounted the acceptance in the market, the bank pays the holder of the acceptance the face value on the maturity date.

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[1] Although acceptances may be created by entities other than banks—such acceptances are referred to as "trade acceptances"—the term "acceptance" in this chapter will refer to bankers acceptances only.

An alternative form of acceptance financing available to the importer involves a letter of credit. If the exporter agrees to this form of financing, the importer has its bank issue a letter of credit on its behalf in favor of the exporter. The letter of credit states that the bank will accept the exporter's time draft if the exporter presents the bank with shipping documents that transfer title on the goods to the bank. The bank notifies the exporter of the letter of credit through a correspondent bank in the exporter's country.

When the goods have been shipped, the seller presents its time draft and the specified documents to the accepting bank's correspondent, which forwards them to the accepting bank. If the documents are in order, the accepting bank takes them, accepts the draft, and discounts it for the exporter. At this point, the transaction is complete from the exporter's point of view; it has shipped the goods, turned over title to them, and received payment.

Once the bank has passed the shipping documents on to the importer, the situation is essentially the same as it was in the case where the bank simply accepted a draft drawn by the importer: The bank may hold the acceptance or rediscount it in the market, and the importer is responsible for paying the bank the face value of the acceptance on or before maturity. There is one subtle difference, however. The drawer of an accepted draft is secondarily liable on it, which means the drawer must pay the holder of the acceptance on maturity if the bank is unable to pay. In the current case, the drawer is the exporter. In the first case described, it was the importer.

An American exporter may seek acceptance financing in a case where it knows the buyer to be creditworthy and wants to extend it credit but needs cash in the interim. Around the time it ships the goods and after completing an acceptance agreement, the exporter draws a time draft on its bank, which accepts and discounts it. Once again, the bank may either hold the acceptance or rediscount it. On or before maturity, the exporter will have to pay the bank the face value of the acceptance. Ideally, the tenor of the acceptance, the time from acceptance to maturity, will coincide with the length of the credit extended by the exporter so that the exporter will be able to pay the bank out of the proceeds of the sale.

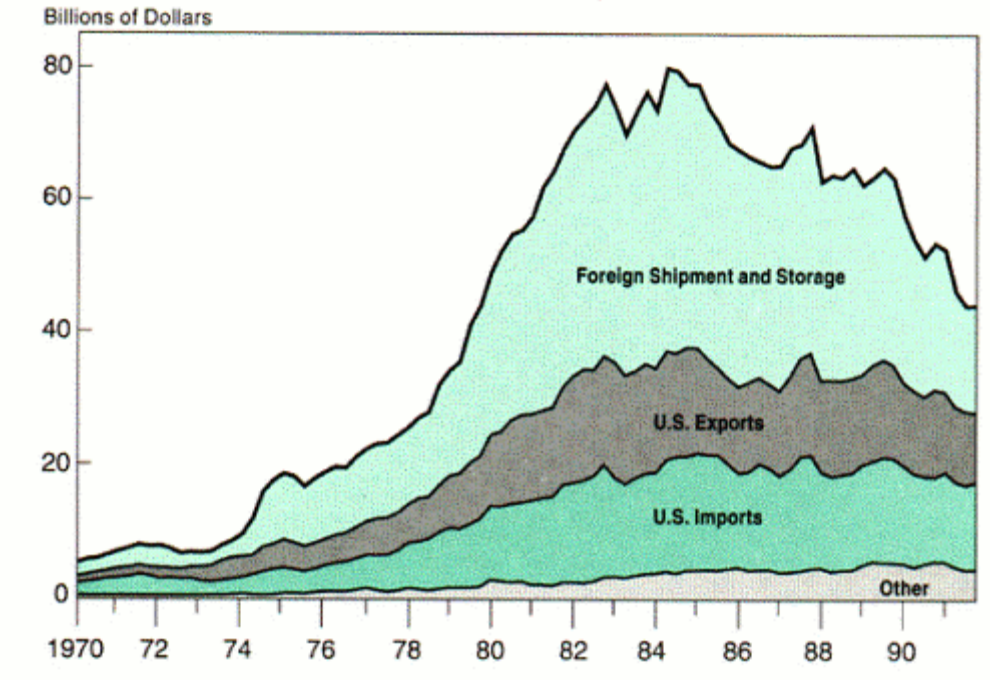
Foreign importers and exporters trading with American firms may obtain acceptance financing in ways similar to those just described. Many acceptances used to finance trade between foreign countries, however, are of a type known as "refinancing" or "accommodation" acceptances. A refinancing acceptance arises from a time draft drawn by a foreign bank on an American bank to finance a customer's transaction. Foreign banks that are not well known in the United States may seek this type of financing because they are unable to sell their own acceptances, or are unable to sell them at reasonable prices, in the U.S. market.

Acceptances are also created to finance the shipment of goods within the United States and to finance the storage of goods in the United States and abroad. Acceptances arising from the shipment and storage of goods in the United

FIGURE 1

Bankers Acceptances Outstanding by Transaction Type

Quarterly Averages of Month-End Figures



Note: Figures are from the Board of Governors' *Annual Statistical Digest*and *Federal Reserve Bulletin*.

States, which are termed "domestic" shipment and storage acceptances, are included in Figure 1 under "other," which includes dollar exchange acceptances—acceptances created to provide banks in certain foreign countries with dollar exchange—until 1984 when they disappeared from the market. As Figure 1 shows, domestic shipment and storage acceptances have been a small part of the market in recent years. On average during 1991, they accounted for 10 percent of acceptances outstanding. Acceptances arising from imports into the United States accounted for 28 percent, those arising from exports from the United States accounted for 24 percent, and those arising from the storage of goods in or shipment of goods between foreign countries accounted for 38 percent.

BANKERS ACCEPTANCES AND THE
FEDERAL RESERVE SYSTEM

Acceptances created to finance the activities listed above—U.S. imports and exports, foreign shipment and storage of goods, the shipment and storage of goods

within the United States, and the provision of dollar exchange—are termed "eligible for discount" if they meet certain additional requirements laid out in the Federal Reserve Act. Eligibility for discount means that a Reserve Bank may rediscount them for accepting banks at the Federal Reserve's discount rate.

The Federal Reserve Act limits the ability to create eligible acceptances to Federal Reserve member banks and to branches and agencies of foreign banks that must hold reserves with the Federal Reserve.[2] Technically, the acceptances of other depository institutions are eligible only if they are endorsed by at least one member bank. In practice, the Federal Reserve has treated the acceptances of other depository institutions as eligible even without such an endorsement (Todd 1988, pp. 272-73).

The Federal Reserve Act places no limits on the types of goods that may be financed by eligible shipment acceptances (those arising from U.S. imports and exports and from the domestic and foreign shipment of goods). The Federal Reserve Act limits eligible storage acceptances, however, to those financing the storage of "readily marketable staples." In an early ruling, the Board of Governors interpreted the phrase to cover manufactured goods and raw materials that are nonperishable and have a "wide ready market" (*Federal Reserve Bulletin* 1916, p. 523). In the same ruling, the Board stated that cotton yarns and flour are covered. The Board later ruled that automobiles and automobile tires and parts are not (*Federal Reserve Bulletin* 1920, p. 65).

The Federal Reserve Act places on storage acceptances the added requirement that they be "secured at the time of acceptance by a warehouse receipt or other such document conveying title." Congress removed a similar documentary requirement for domestic shipment acceptances in 1982.

To be eligible for discount, acceptances must meet requirements concerning tenor. A dollar exchange acceptance must have a tenor of three months or less. Any other type of acceptance must have a tenor of six months or less.[3] However, the Federal Reserve has made it clear from early on that meeting these requirements on tenor does not guarantee eligibility. An acceptance will be eligible only if its tenor roughly corresponds to the time required for the completion of the underlying transaction.

In addition to allowing Reserve Banks to rediscount acceptances for accepting banks, the Federal Reserve Act allows them to purchase acceptances in the open market, but it does not specify what types of acceptances they may purchase.

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[2] There is another category of "eligible" acceptances, those eligible for purchase (described below). Even though there are two types of eligibility, acceptances that are eligible for discount are often simply called "eligible," while those that are not are called "ineligible."

[3] A Reserve Bank may not actually discount an eligible acceptance until it has 90 days or less left to run, unless it is a storage acceptance "drawn for an agricultural purpose," in which case it may be discounted when it has six months or less left to run.

The Federal Open Market Committee determines which acceptances are "eligible for purchase." Acceptances that qualify are those

> with maturities of up to nine months at the time of acceptance that (1) arise out of the current shipment of goods between countries or within the United States, or (2) arise out of the storage within the United States of goods under contract of sale or expected to move into the channels of trade within a reasonable time and that are secured throughout their life by a warehouse receipt or similar document conveying title to the underlying goods. (Board of Governors 1993, *79th Annual Report,* p. 110)

Note that dollar exchange acceptances and acceptances arising from the storage of goods in foreign countries are not eligible for purchase and that domestic storage acceptances may be eligible for purchase only if secured throughout their life by documents conveying title to the goods; storage acceptances may be eligible for discount if they are secured at the time of acceptance by such documents.

The preceding rules on eligibility for purchase and for discount are those currently in force. The original Federal Reserve Act limited eligibility for discount to acceptances "based on the importation or exportation of goods."[4] Congress amended the Act in 1916 to include acceptances arising from the storage of readily marketable staples, from domestic shipments, and from the furnishing of dollar exchange. Until April 1974, when the current rules on eligibility for purchase went into effect, all acceptances that were eligible for discount, along with some others, were eligible for purchase.

The framers of the original Federal Reserve Act gave the Reserve Banks permission to discount and purchase bankers acceptances because they hoped to create a market for acceptances in the United States and to thereby stimulate American foreign trade by lowering the financing costs faced by American importers and exporters.[5] In the years before the Federal Reserve Act was passed, most international trade was financed with acceptances created under letters of credit (Warburg 1910, p. 9). The lack of an American market for acceptances meant that American firms engaging in foreign trade had to obtain financing from European banks, primarily those in London. Financing through London was thought to force American importers and exporters to pay more in commissions than they otherwise would have had to pay, and, since their

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[4] This included foreign shipment acceptances, as the Federal Reserve Board construed "importation" and "exportation" to include the movement of goods between foreign countries as well as between the United States and a foreign country.

[5] Hackley (1973, pp. 53-54), in making this point, quotes from speeches made by Congressman Phelan and Senator Swanson during their respective houses' debates on the Federal Reserve Act. Congressmen Borland, Bulkley, and Helvering expressed the same sentiment (U.S. Congress 1913, *Congressional Record,* pp. 4733, 4785, 4794, and 4798-99).

obligations to the banks in London were denominated in pounds sterling, to expose them to exchange rate risk (Jacobs 1910, p. 13).[6]

The Federal Reserve Banks actively supported the nascent market in the first 18 years following the passage of the Federal Reserve Act. They did so mainly by purchasing acceptances in the open market and not by discounting acceptances offered by accepting banks, the means Congress had expected them to use. They posted buying rates on prime acceptances and bought all acceptances offered at those rates; at times, the posted rates were substantially below market rates. On average, from 1916 to 1931, the Reserve Banks held for their own portfolios over one-third of all outstanding acceptances; at times they held over half of them. They also purchased acceptances for foreign official institutions that held correspondent accounts with them. They endorsed these acceptances, thus freeing their foreign correspondents from the risk of default. Partly on the strength of the Reserve Banks' endorsement, their foreign correspondents purchased large numbers of acceptances. From 1925 to 1931, the foreign correspondents held on average about one-fifth of all acceptances outstanding.

With the support of the Reserve Banks and their foreign correspondents, the acceptance market quickly rose in prominence. As Figure 2 shows, from 1925 to 1931, acceptances financed on average about one-third of U.S. imports and exports. In 1931, the peak of their importance, they financed just under half.

The support of the Reserve Banks and their foreign correspondents fell off dramatically in 1932. From the middle of 1934 until late 1946, they stayed out of the market for the most part. The decline in the acceptance market was equally dramatic, and by 1943 the fraction of America's foreign trade financed by acceptances had fallen to 3 percent.

The market began growing again following World War II, and the Reserve Banks' foreign correspondents resumed regular purchases in late 1946. The Federal Reserve re-entered the market in 1955 when the Federal Open Market Committee authorized the Federal Reserve Bank of New York to enter into repurchase agreements (RPs) in acceptances and to buy and sell acceptances at market rates as means of carrying out the Committee's monetary policy directives. The Federal Reserve sought to support the market, but not to the extent it had in the 1920s. Since 1955, the Federal Reserve and its foreign correspondents combined have not held more than 20 percent of the acceptances outstanding.

During the 1970s, the Federal Reserve decided that the acceptance market had matured to the point that it could stand on its own, and the System gradually withdrew its support. In November 1974, it stopped endorsing acceptances for its foreign correspondents. In March 1977, it decided to stop outright purchases

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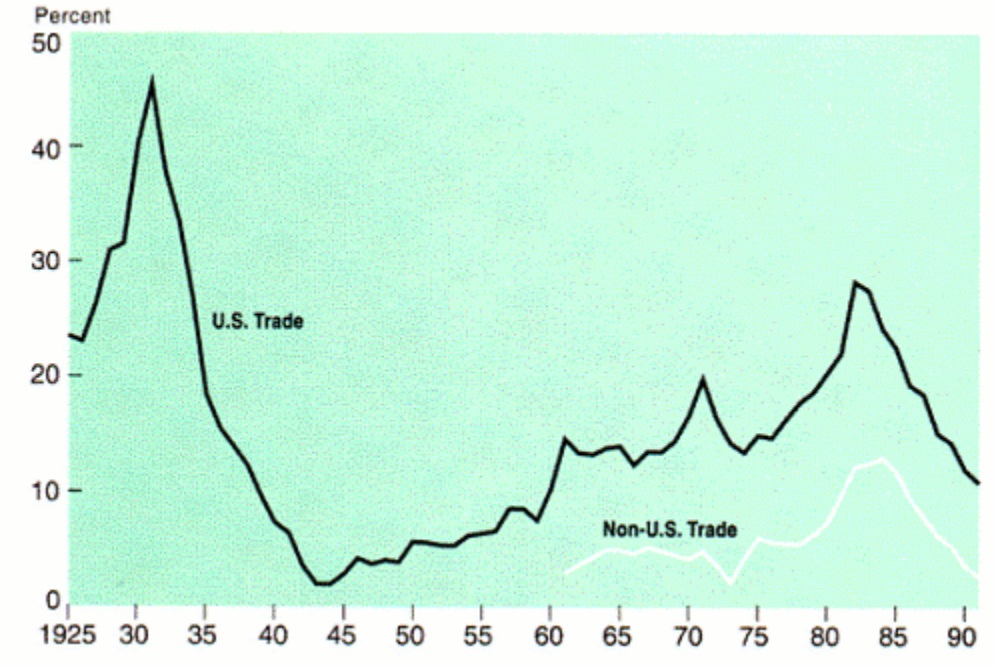
[6] Congressmen Phelan and Helvering quoted from Professor Jacobs during the House's debate on the Federal Reserve Act (U.S. Congress 1913, *Congressional Record,* pp. 4676 and 4798-99).

FIGURE 2

Shares of U.S. and Non-U.S. International Trade

Financed by Bankers Acceptances



Notes: Acceptance figures are from the Board of Governor's *Banking and Monetary Statistics, Annual Statistical Digest,* and *Federal Reserve Bulletin.* U.S. imports and exports are from the U.S. Bureau of the Census' *Historical Statistics, Statistical Abstract,* and FT900 release. Trade figures for the rest of the world are from the International Monetary Fund's *International Financial Statistics.* Shares financed are based on an average maturity of 90 days.

and sales of acceptances, and in 1984 it decided to stop entering into RPs in acceptances.

Even though the Federal Reserve Banks have stopped buying and selling acceptances for their own accounts, eligibility for purchase and eligibility for discount remain significant in that acceptances that are eligible for discount or purchase enjoy favorable treatment in certain areas. Acceptances must be eligible for purchase in order to be bought for the Federal Reserve's foreign correspondents, and they must be eligible for discount or purchase in order to be used as collateral for advances from the discount window. From 1973 to the end of 1990, eligibility for discount conferred an additional benefit: Acceptances outstanding in the market had to be eligible for discount in order to be exempt from reserve requirements.

The exemption from reserve requirements was a significant factor in the growth of the acceptance market in the late 1970s and early 1980s (Jensen and

Parkinson 1986, pp. 5 and 8). The high interest rates in those periods raised the opportunity cost of holding reserves, which do not earn interest. This made it attractive for banks to finance eligible transactions by creating acceptances, discounting them, and rediscounting them in the market rather than by loaning out funds obtained by issuing large CDs, which were subject to reserve requirements.

The value of the exemption is evident in the experience of "working capital" or "finance" acceptances, which are acceptances that do not arise from specific transactions in goods. Of these acceptances, only dollar exchange acceptances are eligible for discount. In July 1973, the Board of Governors started treating ineligible acceptances discounted in the market as equivalent to deposits subject to reserve requirements. Judging by dealers' holdings of working capital acceptances, trading in them had been increasing for at least two years.[7] After the imposition of reserve requirements, trading declined steadily, and, aside from a brief and minor revival in the early 1980s, it has been dormant ever since.

At the end of 1990, the Board of Governors removed reserve requirements from "nonpersonal time deposits," which include ineligible acceptances and large CDs, and from Eurocurrency liabilities, which are net transfers from banks' overseas offices to their U.S. offices. This action bodes ill for eligible acceptances, since it puts CDs and Eurodollar liabilities on a more even footing with them. Even with favorable reserve-requirement status, eligible acceptances had been declining in importance for close to a decade. Judging by this experience, it seems unlikely that the Board's action will lead to a revival in ineligible working capital acceptances.

THE MARKET FOR BANKERS ACCEPTANCES

Borrowers Borrowers in the acceptance market are for the most part firms engaged in U.S. imports and exports and foreign banks seeking to finance international trade not involving the United States. Over the last decade, as Figures 1 and 2 show, both types of borrowers have come to rely less and less on acceptances as a source of financing.

As a source of financing for importers and exporters, acceptances compete with commercial paper, Euro commercial paper, and bank loans. For borrowers with prime ratings, commercial paper is probably the cheapest alternative. Borrowers with less than prime ratings can take out bank loans, issue Euro commercial paper, issue commercial paper with credit enhancements, or issue asset-backed commercial paper. Borrowers of the latter type may find acceptance financing an attractive alternative.

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[7] Figures on dealers' holdings of acceptances can be found in the Federal Reserve Bank of New York's weekly report "Dealer Operations in Bankers' Acceptances."

Apparently, however, they increasingly do not. From 1983, when asset-backed commercial paper and Euro commercial paper were introduced, until 1991, outstandings rose to between $50 billion and $70 billion for asset-backed commercial paper and to $75 billion for Euro commercial paper (see Chapter 9 on commercial paper). Over the same period, commercial and industrial loans made to U.S. businesses by onshore and offshore banks rose from $467 billion to $777 billion (McCauley and Seth 1992, p. 54). The volume outstanding of acceptances based on U.S. imports and exports fell over this period, however, from $31 billion to $24 billion, and the percentage of U.S. foreign trade financed by acceptances fell from 25 percent to 10 percent.

Foreign banks that have no presence in the United States may finance their own acceptances by drawing refinancing acceptances on American banks or by issuing Eurodollar liabilities. Jensen and Parkinson (1986, pp. 9-10) cite the narrowing of the spread between the rates on Eurodollar deposits and bankers acceptances, from nearly 100 basis points in the early 1980s to about 25 basis points in 1985, as a factor in the decline of refinancing acceptances in the first half of the 1980s. Since then, the spread has narrowed even more to under 10 basis points, and the decline in refinancing acceptances has continued, both in terms of volumes outstanding and in terms of the percentage of world trade financed.

Accepting Banks Money center banks, large banks in seaboard states and in the principal grain trading cities, and U.S. branches and agencies of foreign banks create almost all acceptances. Branches and agencies of foreign banks have gained an increasing share of the market over the last decade or so. Their share has risen from about one quarter of all acceptances outstanding in the early 1980s to over 60 percent in 1990 and 1991.

The secondary market for acceptances is tiered, which means that the acceptances of banks with high credit ratings trade at lower rates of discount than the acceptances of banks with lower ratings. Traditionally, the acceptances of money center banks traded at lower rates of discount than those of regional banks and foreign banks. During the 1980s that changed. The spread between the rates of discount on the acceptances of regional banks and those of money center banks, which averaged around 10 basis points in the early 1980s, disappeared in late 1987. The spread between the rates of discount on the acceptances of foreign banks and those of money center banks, which was over 100 basis points when foreign banks were first entering the market, was around 5 basis points in 1990; indeed, the acceptances of some foreign banks traded at lower discounts than those of American money center banks (The First Boston Corporation 1990, p. 154).

Dealers The number of principal dealers in bankers acceptances has been cut roughly in half in the last few years. Today, there are about a dozen, all of which

are also primary dealers in government securities. Dealers in acceptances act as dealers in other money market instruments do, buying and selling acceptances and profiting from the spread between the prices at which they buy and sell. To facilitate their trading, they hold a number of acceptances in their own portfolios; a small number of these they hold until maturity. During 1991, dealers' daily positions in acceptances averaged a little over $1.5 billion.

Investors Bankers acceptances are generally created in amounts over $100,000, so institutional investors dominate the market. On average in 1991, commercial banks held 21 percent of the acceptances outstanding; most of those were their own. Money market mutual funds held 13 percent, dealers held 3 percent, and the Federal Reserve's foreign correspondents held 3 percent. The remaining 60 percent were held by a variety of investors, of which, if relative holdings were like those in previous years, some of the largest were state and local governments, pension funds, and insurance companies (Jensen and Parkinson 1986, p. 4).

Investors consider acceptances to be safe investments because acceptances are "two-name" paper; that is, two parties, the accepting bank and the drawer, are obligated to pay the holder on maturity. Investors are willing to accept a slightly lower return on acceptances than they are on "one-name" paper such as commercial paper and certificates of deposit.

THE OUTLOOK FOR BANKERS ACCEPTANCES

Over the last decade or so a number of developments have diminished the attractiveness of bankers acceptances to both banks and borrowers. Asset-backed commercial paper and Euro commercial paper have been introduced, spreads between rates on Eurodollar deposits and rates on acceptances have fallen, and acceptances have lost their favorable reserve-requirement status. As these developments appear to be permanent, the acceptance market is unlikely to rebound and may even continue to decline in importance.

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Chapter 11
GOVERNMENT-SPONSORED ENTERPRISES

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The ability of savers to exchange loanable funds with borrowers is a foundation of modern economies. In most instances, the exchange is accomplished through financial intermediaries. Intermediaries arise in the private sector because they can profit from their ability to move funds from savers to borrowers at a cost lower than would arise from borrowers and savers acting individually.

Some of the largest financial intermediaries in the United States today are government-sponsored enterprises (GSEs). Beginning as early as 1916, the federal government established these intermediaries to provide funding to sectors of the economy that it considered in need of credit beyond that supplied by purely private financial intermediaries. Government restrictions on private intermediaries' operations were believed to underlie the credit shortfalls. For example, banks in many states were restricted from making loans outside of their local lending areas, effectively preventing them from diversifying their loan portfolios geographically. This inability to diversify, it was contended, led intermediaries to limit their portfolio risk by making fewer real estate loans than they would if diversification had been possible.[1]

Private ownership distinguishes GSEs from credit programs directly affiliated with the federal government. Because GSEs are privately owned, they operate with only limited government direction. Since their funds come from private credit markets, GSEs are excluded from the federal budget, although some have borrowing privileges from the Treasury under certain circumstances. Exclusion from the federal budget places the activities of the GSEs under less congressional review than agencies whose budgets must undergo regular deliberation.[2] Also, the GSEs are exempt from most of the laws and regulations that apply to federal agencies and employees. Finally, any financial gains or losses from the operation of GSEs are distributed among the GSEs' stockholders.

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[1] For a more thorough discussion of this point, see Cacy (1967) and Sellon (1990).

[2] In recent years, however, GSEs have come under increasing scrutiny. Weak earnings and an increasing awareness of the potential risks that GSEs may pose to federal financial resources are partly responsible. The Congressional Budget Office (1991) reviews the risks and proposals to address them.

A GENERAL DESCRIPTION OF THE GSES

Currently, six GSEs are in operation:

- Federal Home Loan Bank System
- Federal Home Loan Mortgage Corporation (Freddie Mac)
- Federal National Mortgage Association (Fannie Mae)
- Farm Credit System
- Federal Agricultural Mortgage Corporation (Farmer Mac)
- Student Loan Marketing Association (Sallie Mae).

As the names suggest, the first three are intended to provide funds to housing, the next two to agriculture, and the last to higher education.

Table 1 summarizes the organization structures, types of operations, and types of assets financed by the various GSEs. As shown in Table 1, the Farm Credit System includes 11 regional banks and three borrower-owned cooperatives as well as many local lender associations, while the Federal Home Loan Bank System operates through 12 regional banks. All other GSEs are single firms.

Some GSEs operate primarily as portfolio lenders and hold most of the assets they purchase or loans they make in their own portfolios. The Farm Credit System, the Federal Home Loan Bank System, and Sallie Mae are primarily portfolio lenders. Other GSEs operate primarily as guarantors of loans. Fannie Mae and Freddie Mac issue mortgage-backed securities that represent fractional ownership of an underlying pool of mortgages originated by private financial institutions, and they guarantee some or all of the timely repayment of interest and principal to the holders of the securities. For this guarantee they deduct a fee from the payments made to the securities' holders.

Table 2 shows a simplified balance sheet for the GSEs. The largest holder of loans purchased from private lenders at year-end 1991 was Fannie Mae, which held over $126 billion of mortgages. Freddie Mac held almost $26 billion of mortgages, and Sallie Mae held over $22 billion of student loans.

The next asset category in Table 2 is loans to private lenders, which includes primarily advances, warehousing advances, and direct loans. Advances are loans made primarily by the Federal Home Loan Banks (FHLBs) to member thrifts to provide liquidity and to encourage growth in their portfolios. Warehousing advances are loans made by Sallie Mae to financial institutions and educational establishments which, in turn, lend the funds to qualified students. These totaled $9.7 billion in 1991. Direct loans are made directly to farmers and to rural homeowners by the Farm Credit Banks or their local associations. As of year-end 1991, these direct loans totaled about $50 billion.

Other assets are cash, other investments, and physical assets such as buildings. For Fannie Mae and Freddie Mac, this category also includes interest receivables, currency swap receivables, and property acquired through foreclosure.

TABLE 1

Characteristics of Government-Sponsored Enterprises

Enterprise	Assets Financed	Organizational Structure	Operations
Farm Credit System			
Farm Credit Banks and affiliated associations	Agricultural operating, production, supply, and real estate loans	11 regional banks, 262 associations; all are borrower-owned cooperatives	Portfolio lenders
Banks for Cooperatives	Loans and leases to agricultural cooperatives, rural utilities, and others	3 national borrower-owned cooperatives	Portfolio lenders
Federal Agricultural Mortgage Corporation	Agricultural real estate and rural housing loans, and loans guaranteed by the Farmers Home Administration	Unitary firm	Guarantor
Federal National Mortgage Association	Residential mortgage loans	Unitary firm	Guarantor; portfolio lender
Federal Home Loan Mortgage Corporation	Residential mortgage loans	Unitary firm	Guarantor; portfolio lender
Federal Home Loan Bank System	Advances secured by residential mortgages or federal agency securities	12 district banks	Portfolio lenders
Student Loan Marketing Association	Federally guaranteed student loans and advances secured by them	Unitary firm	Portfolio lender

Source: Congressional Budget Office.

TABLE 2

Balance Sheets of the Government-Sponsored Agencies

December 31, 1991

	Assets				Liabilities		
	Loans Purchased from Private Lenders	Loans Made to Private Lenders	Other Assets	Total Assets or Total Liabilities + Equity	Credit Market Debt	Other Liabilities	Equity
Federal Home Loan Banks	—	79,065	75,491	154,556	108,149	35,711	10,696
Federal Home Loan Mortgage Corporation	25,800	—	20,323	46,123	30,262	13,295	2,566
Federal National Mortgage Association	126,486	—	20,586	147,072	133,937	7,588	5,547
Farm Credit System	—	49,935	12,568	62,503	53,433	2,671	6,399
Federal Agricultural Mortgage Corporation	—	—	66	66	50	1	15
Student Loan Marketing Association	22,067	9,734	13,519	45,320	43,139	1,031	1,150
TOTAL	174,353	138,734	142,553	455,640	368,970	60,297	26,373

Source: Various 1991 annual reports of the GSEs.

Federal Home Loan Bank System The Federal Home Loan Bank System was created by Congress in 1932 to serve as a lender to savings and loan institutions, mutual savings banks, and mortgage-originating insurance companies. Twelve regional Federal Home Loan Banks were originally established. The activities of the regional banks were coordinated by the banks' common regulator, the Federal Home Loan Bank Board, an independent federal agency.

The National Housing Act, passed in 1934, established the Federal Savings and Loan Insurance Corporation under the System to insure the repayment of savings accounts held by the member institutions in the System. The 1970 Emergency Home Finance Act added the Federal Home Loan Mortgage Corporation (Freddie Mac) to the System.

The FHLBs are owned by their member institutions, which are required to purchase stock in their regional bank. In 1989, the passage of the Financial Institutions Reform, Recovery, and Enforcement Act (FIRREA) expanded the types of financial institutions that may become members of the System by making membership available to commercial banks and credit unions holding 10 percent or more of their portfolio in home mortgages or related assets. Members of the FHLB System receive dividends on their stock, elect a majority of directors to the board of their regional bank, and receive advances and other banking services from the System.

The main service received by FHLB members is advances that provide short-term liquidity or a longer-term source of funds for mortgage loans. The Federal Home Loan Bank System obtains funding for the advances by issuing notes and bonds in the domestic and international capital markets. In addition, the Federal Home Loan Bank System has the right to borrow up to $4 billion from the Treasury.

The FHLBs also provide their members with a variety of other banking services. One of these, designed to help member banks control interest rate risk, is the interest rate swap, whereby the FHLBs and the member institutions formally agree to swap fixed interest rate payments for floating interest rate payments. The interest payment streams are based on a "notional" principal amount which is used for calculating reciprocal cash flows and is not exchanged. Swaps usually allow the member institutions to more closely match their asset and liability interest payments, thereby reducing their exposure to interest rate risk.

The FHLBs also provide member institutions with checking accounts, overnight accounts, and term accounts. These member accounts are interest-bearing and make up roughly 20 percent of the FHLBs' total liabilities.

FIRREA abolished the Federal Home Loan Bank Board and replaced it with the Federal Housing Finance Board, which assumed a broader role in overseeing the FHLBs than had its predecessor. The Federal Housing Finance Board is charged with ensuring that the banks carry out their role in financing housing while maintaining adequate capital.

Federal Home Loan Mortgage Corporation Freddie Mac was authorized by the Emergency Home Finance Act of 1970 and was chartered that same year to provide a secondary market for conventional home mortgages. (Fannie Mae was authorized to buy conventional mortgages concurrently with Freddie Mac.) At the time the legislation was passed, no secondary market for these loans existed. From 1970 through 1989, Freddie Mac was owned by the FHLBs, but FIRREA made it an independent entity and brought it under the control of an 18-member board of directors, five of whom are appointed by the President of the United States. Today, Freddie Mac operates under the direction of the Department of Housing and Urban Development (HUD).

Freddie Mac's mortgage holdings understate its presence in the secondary mortgage market, as it is primarily a mortgage guarantor. Freddie Mac purchases mortgages from financial institutions, places the mortgages in a trust, and issues mortgage-backed securities to investors backed by the principal and interest payments from the mortgages. Because the mortgages are placed in a trust, neither they nor the mortgage-backed securities are listed on Freddie Mac's balance sheet. In 1991, Freddie Mac purchased over $73 billion in 30-year, fixed-rate, single-family mortgages; over $18 billion in 15-year, fixed-rate, single-family mortgages; and almost $8 billion in adjustable-rate mortgages. Against these purchases, Freddie Mac issued over $92 billion in mortgage-backed securities.

Freddie Mac is owned by its stockholders. Its entire outstanding stock is voting common stock,[3] which is listed on the New York and Pacific Stock Exchanges. As of year-end 1991, just over 60 million shares were outstanding.[4]

Federal National Mortgage Association Congress established Fannie Mae in 1938 to provide a secondary market for home mortgages insured by the Federal Housing Administration (FHA). Under the original statute, Fannie Mae financed its purchases of mortgages in the secondary market by borrowing from the public or by raising funds from the issuance of preferred stock to the Treasury. Fannie Mae's authority expanded in 1948 to include the purchase of Veterans Administration mortgages.

In 1954 Congress began to move Fannie Mae toward private ownership. Beginning that year, sellers of mortgages to Fannie Mae were required to purchase stock in Fannie Mae, thus providing private funds for the eventual retirement of the Treasury stock that had provided a portion of the institution's initial funding.

In 1968, Congress made Fannie Mae a federally chartered corporation, wholly owned by private shareholders and overseen by a 15-member board of

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[3] Until February 6, 1990, Freddie Mac also had outstanding nonvoting common stock that did not trade and was held by the Federal Home Loan Banks. On that date, Freddie Mac called and retired the 100,000 shares outstanding at their par value of $1,000 per share.

[4] In March 1992, Freddie Mac's Board of Directors authorized a three-for-one stock split, raising the number of shares outstanding to just over 180 million.

directors. Also during 1968, the Department of Housing and Urban Development acquired regulatory authority over Fannie Mae. Two years later the Emergency House Finance Act of 1970 gave Fannie Mae authority to purchase conventional home mortgages. This change opened up a much larger market segment to Fannie Mae and set the stage for a dramatic expansion of its mortgage purchases.

In 1991, Fannie Mae purchased almost $37 billion in mortgages. Over three-fourths were conventional fixed-rate, single-family mortgages; about $5 billion were adjustable-rate, single-family mortgages; and almost $2 billion were multi-family mortgages. At year's end, about 86 percent of Fannie Mae's total assets of $147 billion were mortgages.

Against these assets, Fannie Mae had $142 billion of liabilities and over $5 billion of stockholders equity. The stock is publicly traded on the New York, Pacific, and Midwest stock exchanges. About 282 million shares were outstanding as of year-end 1991.

Farm Credit System The Farm Credit System was created by the Federal Farm Loan Act, signed into law on July 17, 1916. During the following year, 12 geographically dispersed Federal Land Banks were chartered and an oversight committee, the Federal Farm Board, was formed. The System was designed to make direct long-term loans to farmers for the purchase of real estate. Local associations of member borrowers called Federal Land Bank Associations, organized as lending arms under the banks, originated and administered these direct loans to farmers. By 1932, 5,000 such associations existed nationally. In 1923, a Federal Intermediate Credit Bank was added to each Federal Land Bank to facilitate production loans to farmers. In 1933, local Production Credit Associations were created under the regional Federal Intermediate Credit Banks to originate and service short-term farm production loans. Banks for Cooperatives were also created that year, as a lending arm to serve agricultural cooperatives and rural utilities. Together, the Federal Land Banks, Production Credit Associations, and Banks for Cooperatives composed the Farm Credit System. In 1953 the Farm Credit Act created the Farm Credit Administration, an independent agency of the federal government, to oversee operations of the System.

Congress altered the structure of the Farm Credit System in the mid-1980s in response to the System's earnings losses earlier in the decade. The losses resulted from high loan default rates associated with a financial downturn in the agricultural sector and from deficiencies in the System's management and lending policies. The primary deficiencies were that the value of loans were often based on the underlying value of collateral rather than repayment ability and that interest rates on loans were often tied to the average cost of funds rather than the marginal cost. Legislation passed in 1985 and 1987 changed the way the System operated. The 1985 legislation eliminated the Farm Credit Administration's role in

determining the System's operations policies, instead converting it to a supervisor of the System's safety and soundness. The legislation also instituted loss-sharing agreements among the System's institutions (which requires similar System institutions to jointly cover the financial losses incurred by individual institutions) and required outside audits of regional institutions' operations. More far-reaching legislation, passed in 1987, eliminated one regional Federal Land Bank, merged the Federal Land Banks and Intermediate Credit Banks into regional Farm Credit Banks in the remaining 11 districts, and created the FarmCredit System Financial Assistance Corporation, overseen by the Farm Credit Financial Assistance Board (FAB). At the same time, ten of the regional Banks for Cooperatives merged to form CoBank, a centralized farm cooperative and rural utility lending arm of the System. Two regional Banks for Cooperatives did not join CoBank, instead choosing to operate as they had.

The FAB is a federal agency that oversees the issuance of Farm Credit Financial Assistance Corporation bonds and lends funds to financially troubled Farm Credit Banks. The Farm Credit System Financial Assistance Corporation is authorized to issue up to $4 billion in bonds. The banks that borrow from the FAB are obligated to repay the loans in full, although interest payments on the loans are paid in part by the federal government.

The 1987 legislation also formed the Farm Credit System Insurance Corporation, funded by premiums paid by Farm Credit System lending institutions, to provide a guarantee of timely principal and interest payments to investors in System securities. This same legislation required the Farm Credit Administration to oversee capital standards for System institutions and specified a minimum capital level of 7 percent of each institution's risk-adjusted assets. The Farm Credit Administration has the discretion to increase the capital level if it judges additional capital to be necessary.

The Farm Credit System is the only GSE that directly originates loans to the public. These loans may be either long-term (usually mortgages) or shorter-term (usually farm production or farm operating loans) and are originated through the local associations. Associations obtain their funds from the regional Farm Credit Banks, effectively placing the regional banks in the role of wholesale lenders.

Federal Agricultural Mortgage Corporation Farmer Mac is a federally chartered GSE originally created by the Farm Credit Act of 1971, as amended by the Agricultural Credit Act of 1987. Technically, Farmer Mac operates under the Farm Credit System, but it does not participate in the liability-sharing arrangement of the other System institutions and it is not covered by the System's insurance fund.

The mission of Farmer Mac is to attract new capital to agriculture and to provide liquidity to agricultural lenders by aiding in the development of a secondary market for certain agricultural and rural housing loans. Most loans are

not purchased by Farmer Mac, but are purchased by private poolers that are certified by Farmer Mac. Once loans are purchased by the pooler, Farmer Mac acts as a guarantor. It does this by guaranteeing the last 90 percent of the timely payment of principal and interest on securities backed by the loans. The poolers are responsible for the first 10 percent. Like other GSEs, Farmer Mac earns fees for its guarantor services.

In addition to its guarantor role, Farmer Mac is authorized to set up the standards for loans that qualify for purchase by the poolers, to set up standards for certified facilities to act as loan poolers, to establish standards of loan pools, and, in some cases, to purchase qualifying loans.

Under a program enacted in 1990 called Farmer Mac II, Farmer Mac is authorized to directly purchase portions of agricultural loans that carry direct guarantees from the Farmers Home Administration (FmHA). Farmer Mac funds the purchases by the issuance of securities backed by the loans. Farmer Mac guarantees the timely payment of principal and interest on its securities. The guarantee is backed by the FmHA guarantee on the underlying loans.

Student Loan Marketing Association Sallie Mae is a shareholder-owned corporation established by Congress in 1972 for the purpose of increasing the availability of credit to postsecondary students. To accomplish its goals, Sallie Mae provides funds to financial institutions engaged in lending under the Guaranteed Student Loan Program, and provides a secondary market by standing ready to purchase student loans. The agency is authorized to raise funds through the issuance of stock and debt obligations. The legislation specifies that Sallie Mae is to be overseen by 21 directors: 7 chosen by financial institutions, 7 by educational institutions, and 7 (including the chairman) by the President of the United States. Ownership of voting stock in Sallie Mae is restricted to educational and financial institutions qualified to participate in the Guaranteed Student Loan Program.

Loans that qualify for the Guaranteed Student Loan Program are originated by lending institutions and by certain state agencies and educational institutions. Since 1984, these loans have carried guarantees from state or nonprofit guarantee agencies, which reimburse lenders fully on the first 5 percent of loan losses and on a diminishing basis thereafter. Many originators opt to delay selling the loans during the period that the student remains in school because the government makes the interest payments during that period. Sallie Mae also provides liquidity to the private originators of student loans by making cash advances (called warehousing advances) through the Warehousing Advance Program.

Originally, funding for Sallie Mae's operations came from various sources, including loans from the Federal Financing Bank and sales of debt instruments carrying a federal guarantee. Subsequent to a January 1982 agreement with the Treasury Department, however, Sallie Mae has raised funds only from private market sources and without an explicit federal guarantee.

GSE SECURITIES

The GSEs issue debt securities across a broad spectrum of maturities. The maturity for an individual issue is generally determined by the use to which the funds will be put. Long-term securities are usually issued to fund longer-term direct loans or to fund the purchase of longer-term, fixed-rate loans and mortgages. Short-term securities are usually issued to fund short-term direct loans or to fund the purchase of short-term or variable-rate student or mortgage loans. Except Farmer Mac, GSEs hold a substantial amount of variable-rate loans or other short-term assets with interest rates that adjust relatively frequently, and they therefore issue a substantial amount of short-term securities. Matching the maturities of securities to those of the assets funded by the securities limits the interest rate exposure of these GSEs.

A second reason GSEs may issue short-term securities is to lower their interest rate costs in periods of declining interest rates. During these periods, maturing bonds are retired with proceeds from the issue of short-term securities, with the reissuance of bonds taking place when the GSEs perceive that interest rates have bottomed.[5]

GSEs sell securities to the public through dealer firms. Firms specializing in short-term note issues are typically organized in groups ranging from six to nine members and are composed of both primary and nonprimary government securities bank and nonbank dealers. Firm groups specializing in medium- and long-term offerings are usually larger, ranging up to 180 members.

Dealer group members have written agreements that specify their responsibilities to the GSE and are a precondition for participation in the sale of GSE securities. The agreements usually require that the members (1) support the secondary trading of the GSE securities that they issue, (2) do not obtain primary-issue GSE securities for their own proprietary accounts or for the proprietary accounts of other dealers without the permission of the issuing GSE, and (3) buy the securities for their own proprietary accounts when circumstances dictate and the GSE explicitly requests that they do so. Membership standards for dealers vary across the GSEs, but the standards normally require financial soundness based upon adequate capitalization levels, participation in other sectors of the

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[5] For example, the summary report of the Federal Farm Credit Banks Funding Corporation for 1991 included the following description of the financing activity of Farm Credit Banks for that year:

> Many banks also rolled their maturing bonds into discount notes to take advantage of the declining rate environment, expecting to return to bonds when rates bottomed out and the cost advantage of issuing notes no longer existed. That point was never reached and, although financing needs were lower in 1991 than in 1990, bonds outstanding decreased by a greater percentage as Banks chose to fund a higher portion of assets with discount notes.... As 1991 ended the market appeared to be approaching its bottom, and with it Banks may elect to switch some of their funding back to the bond market. (P. 13)

government securities market, and participation in the secondary market trading of the securities.

GSEs price securities through a cooperative effort with their dealer groups. The primary factor in the pricing decisions is the GSEs' perceptions of the market demand for their securities. Their perceptions are influenced by information they receive about other GSE securities offerings, Treasury offerings, and corporate issues, but their most important source of information is the dealer group members. The members of dealer groups engage in an informal competition among themselves to supply accurate information to the GSEs about the demand for new GSE issues. GSEs claim that this competitive arrangement supplies them with information that allows them to move new issues into the market at the lowest cost possible. Dealer group members perceive that the provision of accurate, timely information places them in a favorable position when the GSEs allocate new-issue securities.[6]

Dealer group members are generally aware of the GSEs' securities issuance schedules and contact the GSEs in advance to get information on the size of the issue and the anticipated price. They then begin to line up orders for the securities from their customers. Orders may be dependent on or independent of the announced price. The size of the security issue is subsequently announced on the wire services. At the time of the announcement, the dealers report to the GSEs the volume of the securities they have "placed" or sold prior to the announcement. The pricing of the issue and allotment of securities to individual dealers occur some days later. At that later date, any shortfall between the announced placement and the amount placed to customers of the dealers is absorbed by the dealers in their own proprietary accounts. Dealers may dispose of the securities in their accounts in any manner they choose.

Short- and Medium-Term Securities Slightly over one-fourth of the outstanding liabilities of GSEs at the end of 1991 were short-term securities (Table 3). The proportion of short-term debt has grown in recent years primarily because of a greater reliance on short-term instruments by Sallie Mae, Freddie Mac, and Fannie Mae. The proportion of short-term debt used by the Farm Credit System and the FHLBs has changed little since the mid-1980s.

Discount notes are the most common of short-term security issued by GSEs. At the end of 1991, $75.7 billion of discount notes were outstanding at the GSEs, accounting for 58 percent of their total short-term debt. Discount notes range in maturity from overnight to 360 days, but individual GSEs may choose to offer only selected maturities. The Federal Home Loan Bank System, for example, does not offer discount notes for maturities of less than 60 days, whereas Freddie Mac prefers the short end of the maturity schedule, usually overnight.

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[6] A more detailed discussion of this process can be found in Appendix D of the *Joint Report on the Government Securities Market* (Department of the Treasury et al. 1992).

TABLE 3

Short-Term (Less Than 1 Year) Debt

as a Percentage of Total Debt

	Year-End 1991
Student Loan Marketing Association	28
Federal Home Loan Mortgage Corporation	61
Federal National Mortgage Association	26
Federal Agricultural Mortgage Corporation	N/A
Farm Credit System	30
FHLB System	22

Source: Various 1991 annual reports of the GSEs.

The minimum denominations of discount notes offered by the GSEs also vary. Sallie Mae and the FHLBs offer discount notes in minimum denominations of $100,000; Freddie Mac, $25,000; Fannie Mae, $10,000; and the Farm Credit Banks, $5,000.

Discount notes are offered on a daily basis. The dealers maintain close contact with investors and are normally able to place the GSEs' desired amount of notes. Commercial banks and money market funds are the major investors in discount notes, although insurance companies and pension funds also purchase some notes. Sales to individuals are rare. Discount notes are normally offered in book-entry form at Federal Reserve Banks and upon maturity may be redeemed in immediately available funds.[7] The dealer groups deduct a fee of 5 basis points (50¢ per $1,000) of the dollar value of the notes placed. The fee is calculated on an annual basis; thus, the actual fee for an individual issue is only a fraction of the 5 basis point figure as the discount note issues are for terms of less than a year.

In addition to discount notes, some GSEs issue other short- to medium-term securities such as Master Notes, Residential Financial Securities, and medium-term notes. Sallie Mae and Fannie Mae issue Master Notes, which are interest-bearing instruments with the interest payments reset weekly at a spread above the auction-determined yield of 91-day Treasury bills. Master Notes are callable with a seven-day notice at any point after three weeks from their issuance. These securities have a maturity between 1 and 18 months and a minimum denomination of $10 million.

Fannie Mae also raises short-term funds through the issuance of Residential Financial Securities. These securities are generally issued for terms of six months, one year, or two years and are unsecured general obligations of Fannie Mae.

[7] Immediately available funds—also referred to as fed funds—are funds that are transferred over the Federal Reserve's wire system.

Residential Financial Securities have denominations of $10,000 or higher, are issued in book-entry form, and are redeemed in immediately available funds.

Freddie Mac issues medium-term notes. Medium-term notes are unsecured debt securities that usually mature between three and seven years. These securities may be issued with a fixed rate of interest, with a variable rate (tied to LIBOR, the London Interbank Offered Rate), or as a zero coupon (sold at a discount and redeemed at par). Medium-term notes are issued both in book-entry form at the Federal Reserve and in registered, certified form. The notes are available in denominations of $10,000 and in additional increments of $5,000.

Long-Term Securities Fannie Mae and Freddie Mac meet most of their long-term financing needs through the issuance of debentures. Debentures are long-term debt instruments secured only by the creditworthiness and earning power of the issuing GSEs; nevertheless, they enjoy a reputation as relatively safe investments. Debentures are normally sold monthly, although they may be issued at other intervals. Approval by the Treasury is required for the sales in order to avoid the simultaneous issuance of GSE debt with that of Treasury debt. Like the short-term debt instruments of the GSEs, debentures are sold primarily through dealer groups, are usually issued in book-entry form at the Federal Reserve Banks (though they are sometimes available in registered, certified form), and are usually redeemable in immediately available funds.

Debentures may be offered with a fixed or floating rate. In most cases the floating rate is tied to the rate on like-maturity Treasury securities, but the floating rate on some Freddie Mac debentures is tied to LIBOR.

The Federal Home Loan Bank System's primary source of long-term funding is consolidated bonds. These instruments are the joint obligations of all of the FHLBs, but are not formally secured by the assets of the FHLB System. The FHLBs, however, are required to maintain certain types of high-quality assets, free from any lien or pledge, in a total amount equal to outstanding consolidated bonds (other than consolidated bonds specifically subordinated to outstanding consolidated bonds). The bonds normally are made available through scheduled monthly sales but may be sold more frequently. The bonds are in minimum denominations of $10,000 and in additional increments of $5,000. Interest is paid semiannually, and settlement is in immediately available funds.

The Farm Credit System also issues consolidated bonds as its primary long-term instrument, but these bonds represent formal claims against the System's assets. These bonds usually carry a fixed rate of interest and are sold in multiples of $1,000. Sales occur up to 16 times per year through the System's dealer group.

In addition to debentures and consolidated bonds, GSEs sometimes offer more exotic long-term debt instruments. Fannie Mae, the FHLB System, and Sallie Mae target foreign investors through a variety of debt offerings that are denominated in foreign currencies.

Mortgage-Backed Securities Mortgage-backed securities (MBSs) give investors pro-rata ownership rights in an underlying pool of mortgages. As such, the interest and principal payments that investors receive depend directly on the payments made by borrowers, including any proceeds from the prepayment of the mortgages.

MBSs are not explicit balance sheet liabilities of Fannie Mae or Freddie Mac, but they are contingent liabilities because Fannie Mae and Freddie Mac guarantee the timely payment of interest and principal by the underlying mortgages to the MBS holders, including the full principal in the event of foreclosure. Thus any shortfall in payments by borrowers exposes Fannie Mae and Freddie Mac to credit risk.

GSEs earn fee and interest income from MBSs. Fees are paid by investors to the GSEs for the guarantee of timely repayment of principal and interest. GSEs also earn interest on payments they hold until the time they pass the payments on to the holders of the MBSs.

In recent years, a variety of innovative MBSs have been developed in order to attract a broader range of investors. One of the largest innovations has been the "lender swap mortgage-backed security" in which the financial institution is allowed to trade a portfolio of its mortgages to the GSEs for securities backed by those loans. The GSEs in turn perform the role of a "credit enhancer" by guaranteeing the timely repayment of both principal and interest.

Another innovation has been the issuance of MBSs in classes based on the anticipated prepayment risk of the underlying mortgages. Investors in these collateralized mortgage obligations (CMOs) may choose a securities class that will be retired from early prepayments of mortgage principal (a short maturity) or from the last prepayments or repayments of principal (a long maturity). CMOs proved popular with investors when they were introduced in 1983. However, changes made to the tax laws in 1986 limited the appeal of CMOs to investors.

A subset of CMOs called real estate mortgage investment conduits (REMICs) were created in response to the 1986 tax law changes. These securities are similar to standard CMOs but are offered with terms designed to overcome some of the accounting and tax complexities inherent in CMOs.[8] REMICs have proven popular with investors as evidenced by the fact that over half of all MBSs issued by Fannie Mae and Freddie Mac in 1991 were REMICs.

The issuance of MBSs by Fannie Mae and Freddie Mac has increased rapidly in recent years. Fannie Mae had $372 billion of MBSs outstanding at the end of 1991 compared to just $178 billion three years earlier. Freddie Mac had $359 billion in outstanding MBSs at year-end 1991, compared to $226 billion at the end of 1988.

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[8] For a more complete discussion of REMICs, see Konstas (1987).

The Secondary Market for GSE Securities GSE debt securities are exchanged in over-the-counter secondary market trading through the same dealer firms who are the primary issuers of the securities. Dealers earn income from bid-ask spreads and from the net interest earnings on securities holdings.

The volume of trading in GSE debt securities is much smaller than in the mammoth Treasury market, but the GSE market is sufficiently broad to ensure that the GSE securities are still considered very liquid. Most trading is concentrated in relatively short maturities.

Yields Yields on GSE debt are normally somewhat higher than those of comparable maturity Treasury securities, but the spreads typically have been relatively small because investors have viewed GSE debt as having an implicit federal guarantee against default. Twice during the 1980s, however, the spreads between some GSE debt and Treasury securities widened substantially because of investors' uncertainty regarding the financial health of the issuing GSEs and uncertainty over whether the government would make the presumed federal guarantee explicit.

The first episode took place in early 1980, when Fannie Mae financed a portfolio of long-term mortgages with short-term debt. When interest rates subsequently rose sharply, Fannie Mae's profit margins decreased substantially. As a result, from 1980 through 1985 Fannie Mae experienced only two profitable years. The lower profits combined with investor uncertainty over whether the government would rescue Fannie Mae led to a larger interest rate spread between Fannie Mae and Treasury securities.

The Farm Credit System ran into financial trouble somewhat later in the decade, and it posted losses totaling $4.6 billion from 1985 through 1987. These losses originated from loan defaults that resulted from financial weakness in the agricultural sector in the early to mid-1980s and overly optimistic assessments of the value of farmland pledged as collateral for mortgage loans made by the System. Also contributing to earnings losses was the long-term, fixed interest rate structure of the System's liabilities combined with the short-term, variable interest rate structure of its assets. As interest rates declined over this period, the System found that their cost of funds exceeded the return from their loan portfolio, resulting in earnings losses. The System's losses raised fear in the financial markets that it would default on some securities if the Treasury did not lend assistance. This fear was reflected in the wider premium investors required to hold Farm Credit System securities, as shown in Figure 1.

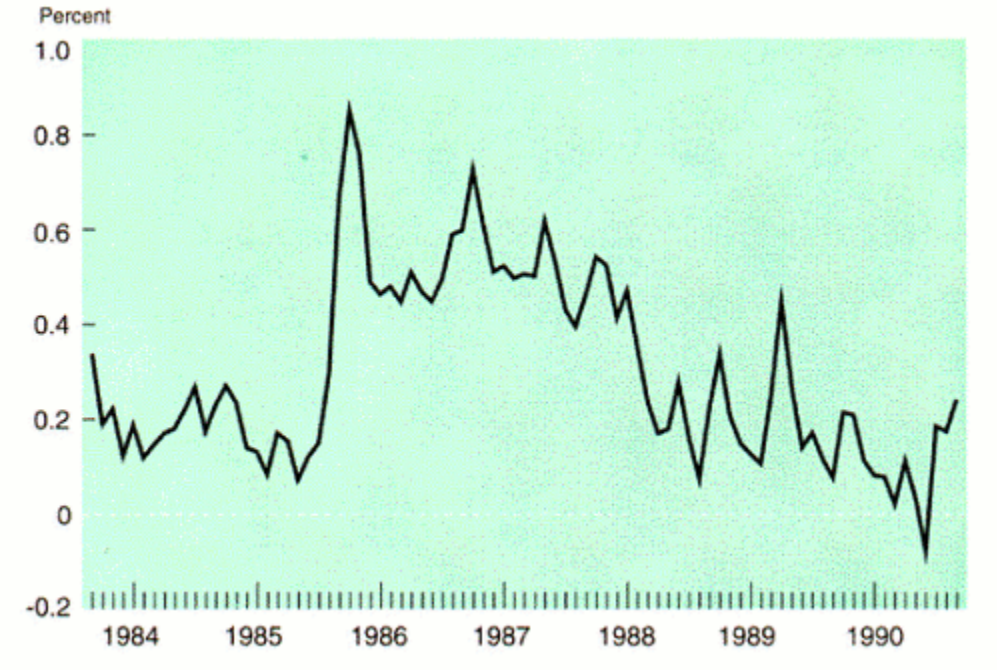
In both episodes, the federal government eventually made the implicit guarantees explicit by providing federal government loans to the GSEs. Once the loans were made, the interest rate spread of the GSE securities and comparable U.S. Treasury securities narrowed.

FIGURE 1

Yield Spread Between Farm Credit and

U.S. Treasury Bonds of Comparable Maturity

(Farm credit bond maturing on 10/22/90; T-bond maturing on 10/15/90)



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Chapter 12
MONEY MARKET MUTUAL FUNDS AND OTHER SHORT-TERM INVESTMENT POOLS

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Short-term investment pools (STIPs) are financial intermediaries that purchase large pools of short-term financial instruments and sell shares in these pools to investors. Because it typically takes at least $100,000 to purchase most money market instruments, STIPs allow investors to gain access indirectly to money market yields with much smaller amounts of money than is possible through direct investment. STIPs also provide many investors greater liquidity, diversification, and a higher yield net of expenses than could be obtained by direct investment.

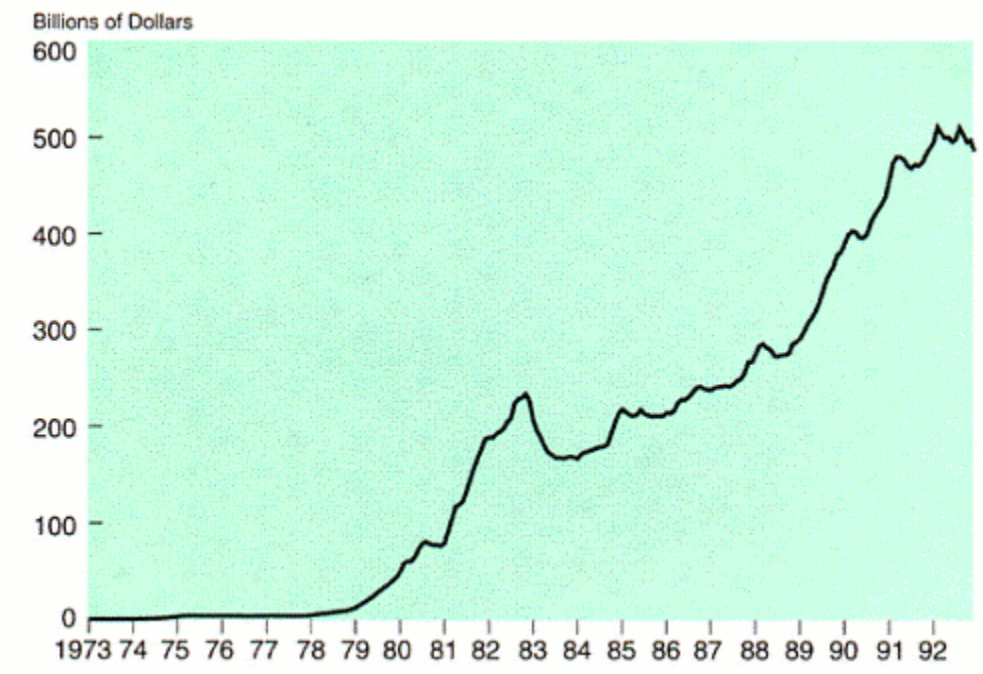
The three major types of STIPs are money market mutual funds, short-term investment funds, and local government investment pools. Money market mutual funds are operated primarily by brokerage companies and mutual funds groups which sell shares in these funds to a wide variety of individual, corporate, and institutional investors. Short-term investment funds are operated by bank trust departments for their different accounts. Local government investment pools are typically established by individual state governments for their local governments. At the end of 1992, STIPs held over $700 billion in assets and played a significant role in the nation's money market.

MONEY MARKET MUTUAL FUNDS

Money market mutual funds (MMFs) can be divided into two categories: (1) taxable funds, which invest in securities such as Treasury bills and commercial paper that pay interest income subject to federal taxation, and (2) tax-exempt funds, which invest exclusively in securities that are exempt from federal taxation issued by state and local governments. Because of their unique investment strategy, tax-exempt funds appeal to a different group of investors than taxable MMFs and have experienced a different pattern of growth. For this reason, taxable and tax-exempt funds are discussed separately below.

FIGURE 1

Taxable MMF Assets



Source: Board of Governors of the Federal Reserve System.

Taxable Funds[1] The first MMF began offering shares to the public in 1972. MMFs experienced their initial period of rapid growth in 1974 and early 1975 when money market interest rates rose well above the Regulation Q ceiling rates that depository institutions were permitted to pay on small time and savings deposits. The level of MMF assets rose to almost $4 billion by mid-1975 and remained in a range of $3 billion to $4 billion until the end of 1977 (Figure 1). Explosive growth in MMFs then occurred in the late 1970s and early 1980s when very high money market rates resulted in large differentials between the rates paid by MMFs and the ceiling rates at depository institutions. From the end of 1977 to November 1982 MMF assets rose from $4 billion to $235 billion.

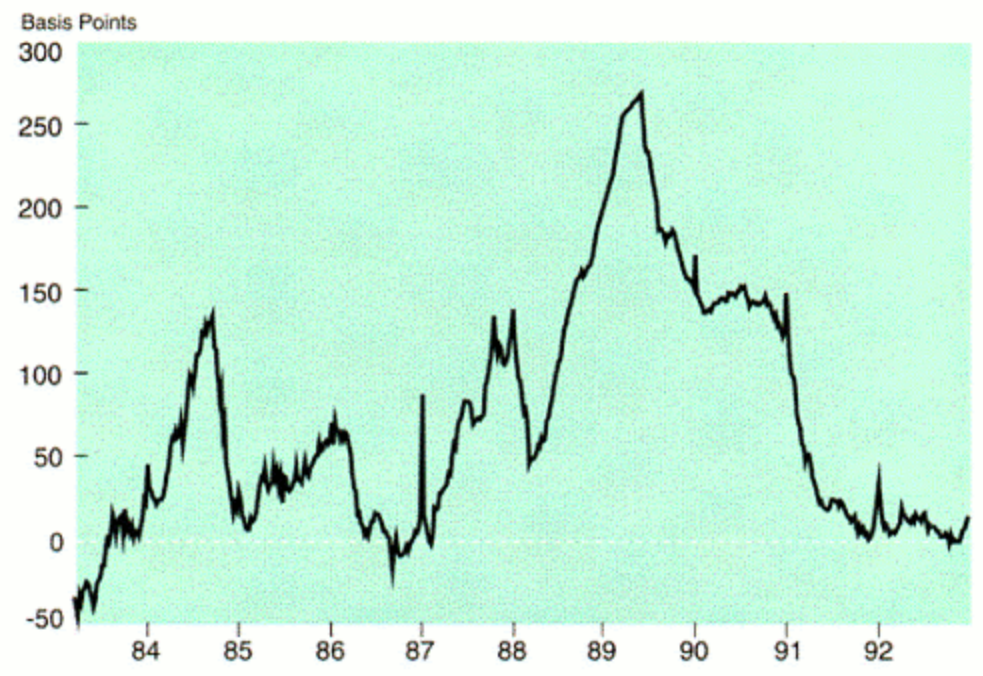
To counter the outflow of savings balances from depository institutions, Congress, in December 1982, authorized depository institutions to offer an account free of interest rate ceilings called the money market deposit account (MMDA). A month later the Depository Institutions Deregulation Committee

[1] Data presented in this section are for taxable money market funds only.

FIGURE 2

The Spread Between the Average Yield on MMFs and MMDAs

(Weekly Data, 3/16/83 to 12/29/92)



Source: MMF yields are from IBC's *Money Market Insight* of Ashland, Mass. MMDA yields are from *Bank Rate Monitor* of North Palm Beach, Fla.

authorized another ceiling-free account called the Super-NOW account. Many depository institutions initially offered MMDAs at rates well above those paid by MMFs (Figure 2), and as a result from November 1982 to the end of 1983 MMF assets fell by $67 billion. Average MMDA rates fell below average MMF yields in August 1983, and this led to a resumption of MMF growth in early 1984. By the middle of 1986 MMF assets had returned to their late 1982 level. MMF rates remained well above MMDA rates over most of the period from 1986 through 1991, and MMFs grew at a rapid annual rate of 15 percent over this period. At the end of 1992 there were 563 taxable MMFs with total assets of $452 billion and a total of over 20 million shareholder accounts.

MMFs have become key components of the investment programs offered by mutual fund groups and brokerage companies. It seems likely that the strong growth of MMFs from 1984 through 1991 resulted not only from their competitive rates but also from the rapid growth of the brokerage business and the mutual fund industry over this period. (Mutual fund assets, excluding MMFs,

grew from $113 billion at the end of 1983 to $1,056 billion at the end of 1992.) Investors often use MMFs as a parking place for cash reserves awaiting investment in longer-term financial assets such as stocks and bonds. They also frequently exchange MMF shares for the shares of other funds in their mutual funds group. Further, MMFs are generally the core vehicle in the popular cash management accounts offered by large brokerage firms.

Individuals are the largest investors in MMFs. They generally purchase MMF shares through brokerage firms or directly from mutual fund groups by mail, telephone, bank wire, or occasionally at offices maintained by the fund organizations.

A variety of institutional investors, including bank trust departments, corporations, and retirement plans, also use MMFs. The largest institutional investors are small and medium-sized bank trust departments which use MMFs as a means of earning a market rate on the short-term reserves of their personal and employee benefit trust accounts. (Large trust departments often set up their own internal pooling arrangements called short-term investment funds, which are described below.) Small, midsize, and even some larger corporations also use MMFs for cash management purposes. A special category of MMFs, generally labeled "institutions-only," has evolved to deal solely with institutional investors. These funds offer an array of services specially designed to meet the needs of institutions, such as electronic hookups between the institution and the fund and subaccounting services to facilitate recordkeeping of a bank's trust accounts. There were 144 taxable institutions-only MMFs at the end of 1992 with total assets of $145 billion.

Brokerage firms and mutual fund groups were traditionally the sole suppliers of money market fund services. However, banks have become increasingly involved in the industry in recent years. The Glass-Steagall Act of 1933 prevents banks from underwriting or distributing mutual fund shares. Legal decisions in the late 1980s, however, established the right of a bank to serve as a fund's investment advisor and the right to advise its customers to invest in funds managed by the bank. As a result, numerous banks have started their own proprietary MMFs. To conform to the requirements of the Glass-Steagall Act, these banks hire an outside firm to act as distributor of the fund's shares. Under this arrangement the bank earns the investment advisory fee, which is typically the largest expense in operating an MMF, and may also earn other fees related to various aspects of the fund's operations. By the end of 1992 bank proprietary money market funds had assets totaling over $90 billion.

The general operating characteristics of MMFs are fairly standard. Minimum initial investments usually range from $500 to $5,000, although a small number of funds require no minimum and institutions-only MMFs typically require minimums of $50,000 or more. Most funds have a checking option that enables shareholders to write checks against their account, usually with a minimum of $500 per check. Shares can also be redeemed at most MMFs by telephone or

wire request, in which case payment by the MMF is either mailed to the investor or remitted by wire to the investor's bank account.

MMFs follow varying investment policies. One group of funds limit their assets to U.S. Treasury securities, including in some cases repurchase agreements collateralized by Treasury securities. A second group invests in securities of both the U.S. government and various government-sponsored enterprises. The third and largest group of funds also invests in a variety of privately issued money market securities that have received the highest credit rating by the national rating agencies—i.e., A1 by Standard & Poor's and P1 by Moody's. Prior to June 1991, many funds invested in privately issued securities with ratings below A1-P1, but the number of funds doing so dropped sharply following restrictions (discussed below) placed on these investments by the Securities and Exchange Commission.

Table 1 shows the aggregate composition of MMF assets in December 1992. At that time 37.5 percent of total MMF assets was held in commercial paper, 17.8 percent in U.S. Treasury securities, 11.9 percent in securities of other federal agencies or government-sponsored enterprises, 15.2 percent in repurchase agreements, 7.4 percent in domestic CDs, 4.1 percent in Eurodollar CDs, and 1.4 percent in bankers acceptances.

TABLE 1

Composition of Taxable MMF Assets

(December 1992, in billions of dollars)

	Amount	Percent of Total
U.S. Treasury bills	47.4	10.5
Other Treasury securities	33.2	7.3
Other U.S. securities	53.9	11.9
Repurchase agreements	68.8	15.2
Commercial bank CDs*	5.1	1.1
Other domestic CDs†	28.3	6.3
Eurodollar CDs**	18.6	4.1
Commercial paper	169.5	37.5
Bankers acceptances	6.4	1.4
Other	21.3	4.7
TOTAL	452.5	100.0

*Commercial bank CDs are those issued by American banks located in the United States.

† Other domestic CDs include those issued by S&Ls and American branches of foreign banks.

** Eurodollar CDs are those issued by foreign branches of domestic banks and some issued by Canadian banks.

Source: Investment Company Institute.

The percentage of MMF assets invested in Treasury securities rose sharply in the latter half of the 1980s. One factor that may have contributed to the greater investment in Treasury securities was the passage by most states of legislation that, in effect, raised the after-tax return earned by MMF shareholders on their funds' holdings of Treasury securities. Federal law prohibits states from taxing the interest income earned on securities issued by the U.S. government and by some government-sponsored enterprises such as the Farm Credit System. (This prohibition does not extend, however, to other government-sponsored enterprises such as the Federal National Mortgage Association and the Federal Home Loan Credit Bank.) In recent years, almost all states have passed legislation permitting the pass-through of this tax-free status from an MMF to its shareholders. The pass-through typically means that all interest income earned by a fund from eligible securities can be passed through to shareholders as income exempt from state taxes. (A few states require that a certain percentage of a fund's assets—usually 50 percent—be invested in eligible securities for the pass-through to apply.)

The weighted-average maturity of taxable MMF assets ranged from 28 to 55 days over the six-year period ending December 1992 and reached its highest levels in the last two years of that period (Investment Company Institute). The major influence on maturity appears to be the interest rate expectations of MMF investment advisors, some of whom extend their fund's maturity when they expect interest rates to fall.

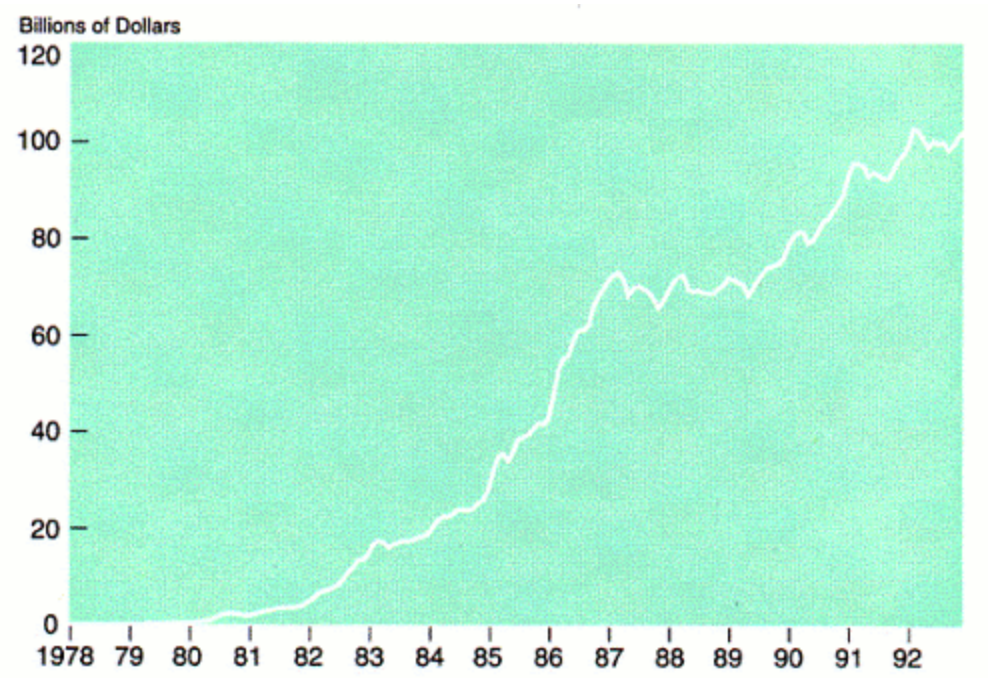
Tax-Exempt Funds Tax-exempt money market funds invest in securities issued by state and local government entities that pay interest income that is exempt from federal income taxes. Otherwise, they generally have the same features and operating characteristics as other MMFs. The first tax-exempt fund offered shares to the public in 1977, but tax-exempt funds did not begin to experience rapid growth until the early 1980s (Figure 3). At the end of 1992 there were 307 tax-exempt MMFs with total assets of $96 billion and 1.5 million shareholder accounts. This included 45 institutions-only funds with total assets of $17 billion.

An important trend in recent years has been the proliferation of tax-exempt money market funds that buy only securities issued by governments within a particular state. Such funds offer investors from those states interest income exempt from federal, state, and, sometimes, local income taxes.[2] State-specific tax-exempt funds have proliferated mainly in states with high tax rates and large populations. The high tax rate stimulates the demand for the state's securities by in-state residents, while the large population provides a market big enough for the MMF sponsor. As shown in Table 2, by far the most tax-exempt MMFs are found in California and New York, two states with high tax rates and large populations.

[2] Investors in these funds, however, sacrifice the diversification available by investing in non-state-specific funds.

FIGURE 3

Tax-Exempt MMF Assets



Source: Board of Governors of the Federal Reserve System.

At the end of 1992, state-specific tax-exempt MMFs held about one-third of total tax-exempt MMF assets.

Because tax-exempt money market funds invest in tax-exempt securities, they appeal to investors in the highest federal income tax brackets. To consider the decision faced by such investors, suppose the yield earned by taxable MMFs is YT and the yield earned by tax-exempt MMFs is YTE. Then an investor with a marginal income tax rate of t will earn an after-tax yield of $YT(1 - t)$ by investing in the taxable MMF and YTE by investing in the tax-exempt MMF. The break-even tax rate, t^*, at which an investor would earn the same after-tax rate in a taxable and tax-exempt MMF is:

$$t^* = 1 - (YTE/YT).$$

An investor with a marginal tax rate greater than the break-even rate would earn a higher after-tax yield in a tax-exempt money fund than in a taxable money fund.[3]

[3] The actual value of the break-even tax rate also depends on differences in the credit quality and maturity of the assets held by taxable versus tax-exempt funds.

TABLE 2

Tax-Exempt MMFs

(December 1992, in millions of dollars)

	General Purpose		Institutions-Only		Total	
	Number	Assets	Number	Assets	Number	Assets
California	43	11,894.9	5	1,130.3	48	13,025.2
Connecticut	11	1,357.9	1	138.9	12	1,496.8
Florida	1	17.9	0	0.0	1	17.9
Massachusetts	8	1,416.4	1	115.0	9	1,531.4
Michigan	5	606.1	0	0.0	5	606.1
Minnesota	1	70.0	1	207.6	2	277.6
North Carolina	2	420.7	0	0.0	2	420.7
New Jersey	11	2,886.1	2	81.8	13	2,967.9
New York	34	6,177.0	4	571.7	38	6,748.7
Ohio	9	1,326.1	1	61.7	10	1,387.8
Pennsylvania	7	1,587.9	1	320.4	8	1,908.3
Virginia	1	75.4	0	0.0	1	75.4
TOTAL	133	27,836.4	16	2,627.4	149	30,463.8
Not State-Specific	129	51,121.8	29	14,326.1	158	65,447.9
GRAND TOTAL	262	78,958.2	45	16,953.5	307	95,911.7

Source: IBC's *Money Market Insight,* Ashland, Mass.

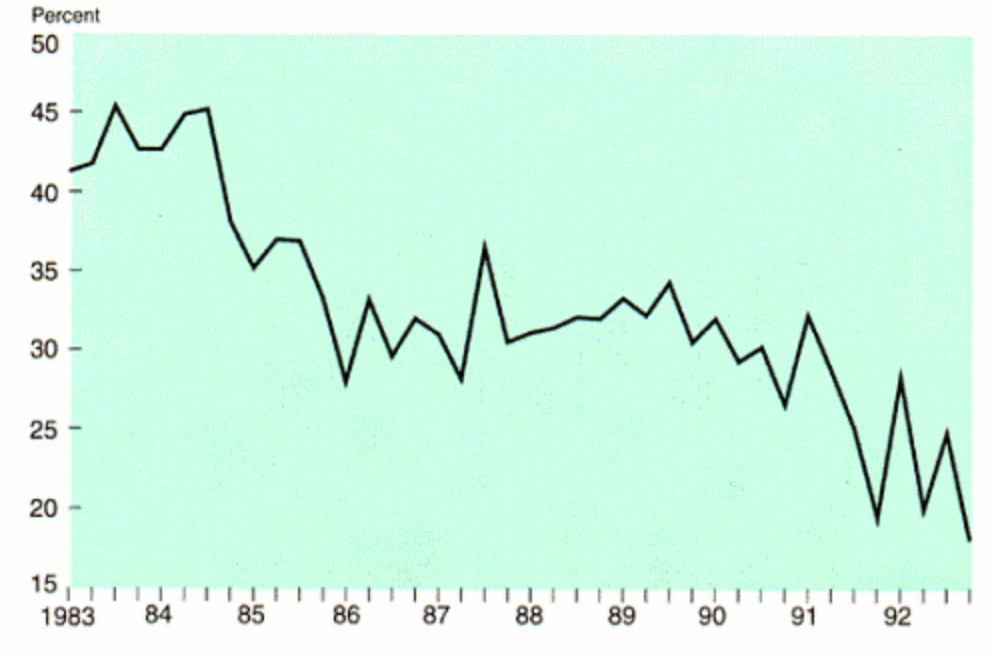
Figure 4 shows that in the early 1980s the break-even rate was generally in a range of 40 to 45 percent. In the period from 1986 through 1990, however, it declined to a range of 30 to 35 percent. The major factor underlying the lower break-even rate in the latter period was the Tax Reform Act of 1986, which reduced the top individual marginal tax rate from 50 to 33 percent. Following this reduction, investors required a higher before-tax yield on tax-exempt investments—relative to the yield on taxable investments—than they had required earlier. (The highest marginal tax rate was reduced further to 31 percent in 1991.) The 1986 Act also eliminated the ability of banks to deduct from their taxable income any of the interest expenses incurred to fund holdings of municipal securities, which sharply reduced banks' demand for these securities. (Prior to the 1986 Act, banks could deduct 80 percent of the expenses incurred to fund holdings of municipal securities.)

Tax-exempt MMFs invest in a variety of short-term, tax-exempt securities, including anticipation notes, tax-exempt commercial paper, and variable-rate demand obligations. The latter securities have periodic interest rate adjustments and include a demand option that gives the fund the right to tender the instrument to the issuer or a designated third party on a specified number of days' notice at a price equal to the face amount plus accrued interest. At the end of 1992

FIGURE 4

Tax Rate Equating After-Tax Yields on

Taxable and Tax-Exempt MMFs



Source: MMF yields are from IBC's *Money Market Insight* of Ashland, Mass.

roughly 50 percent of the securities held by tax-exempt MMFs were variable-rate demand obligations.

Share Valuation, Risk, and Regulation The Investment Company Act of 1940 requires a mutual fund to determine its price per share on the basis of the current market value of the securities held by the fund. The Securities and Exchange Commission (SEC), however, has the authority to give exemptions to this provision, and under this authority it has specified limitations (described below) under which MMFs can use accounting procedures that enable them to offer investors a stable share value of $1. Virtually all MMFs follow these conditions because they want investors to view shares in an MMF as close substitutes to savings and time deposits at commercial banks and other depository institutions.

In order to maintain a constant share value, most money market funds use the "amortized cost" method of valuation. Under this method securities are valued at acquisition cost rather than market value, and interest earned on each security (plus any discount received or less any premium paid upon purchase) is accrued uniformly over the remaining maturity of the purchase. By declaring these accruals as a daily

dividend to its shareholders, the fund is able to maintain a stable price of $1 per share.

Other money funds use a second procedure called "penny rounding" to maintain a stable share value. Under this procedure the share value is calculated by rounding the per share market value of the fund to the nearest cent on a share value of a dollar. If the market value of a share is kept within one-half cent of a dollar, this accounting procedure allows the funds to offer a stable $1 share value.[4]

The potential problem with these procedures is that under certain conditions a gap may develop between the true market value of a fund's share and the $1 stated value. For example, if interest rates rise, the market value of the MMF's assets will fall below the value used by amortized cost valuations. The longer the average maturity of a money market fund's portfolio, the greater the possible fluctuation in the true market value around the stated $1 value. Similarly, the market value of a fund may fall below the stated value because of credit problems on some of the commercial paper or other assets held by the fund. Lastly, the greater the investment by a fund in a particular company's securities, the greater the possibility that the credit problems of one company could lead to a significant divergence between the stated share value of a fund and its underlying market value.

A significant divergence between the stated $1 value and the market value of a fund's share would create an incentive for investors to redeem their shares quickly. Investors who redeemed their shares at $1 would receive more than their fair share of the funds assets, and the interests of the remaining shareholders would be unfairly diluted. Eventually, a fund in this situation would be forced to devalue its shares below $1, or "break the dollar" in the jargon of the money fund industry.

To minimize the likelihood of a divergence between a fund's stated $1 share value and the true market value, the SEC as early as 1977 began to regulate the conditions under which MMFs were allowed to use various accounting procedures.[5] In 1983 the SEC issued Rule 2a-7 which codified the conditions required to be met by all money market funds that wished to use the amortized cost or penny-rounding methods of valuation. These conditions, sometimes called the risk-limiting rules, specify guidelines governing the maturity, credit quality, and diversification of the assets of a fund that wishes to use the amortized cost or penny-rounding methods of valuation.

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[4] The SEC in 1977 interpreted the Investment Company Act to mean that on a share value of a dollar a fund had to round its share price within 1/10 of a cent of the per share market value (Release 9786, May 31, 1977). In other words, a fund with a per share market value of 99.90 cents could round up to a dollar but a fund with a per share market value of 99.85 cents could not. Penny rounding allows a fund with a per share value as low as 99.50 cents to round up to a dollar.

[5] Cook and Duffield (1979a, pp. 16-17) relate the early history of the SEC's rulings governing share valuation.

Rule 2a-7 required that funds using the amortized cost or penny-rounding methods of valuation maintain an average dollar-weighted maturity of no more than 120 days and not acquire any security with a maturity greater than a year. The rule also required that such MMFs purchase only securities rated "high quality" by a major rating service or, if unrated, judged by the fund's board of directors to be of comparable quality. This ruling, in effect, required that MMFs using the amortized cost or penny-rounding methods of valuation purchase securities rated A1 or A2 by Moody's or P1 or P2 by Standard & Poor's.

In 1986 the SEC amended Rule 2a-7 to specify conditions under which funds relying on the rule could acquire securities with demand features and to indicate how the maturity of variable-rate or floating-rate securities with demand features would be determined for the purposes of meeting the maturity requirements of the rule. Most importantly, the maturity of a variable-rate security with a demand feature (required by the rule to be exercisable on no more than 30 days' notice) was deemed to be equal to the longer of the period remaining until the next readjustment of the interest rate or the period remaining until the principal can be recovered through demand. This amendment was particularly important to tax-exempt money market funds because it enhanced their ability to acquire long-term variable-rate securities with demand features while still maintaining a constant $1 share value.

Events in the commercial paper market in 1989 and 1990 led the SEC in 1991 to reevaluate the risk-limiting provisions of Rule 2a-7. Prior to 1989, there had been only two major commercial paper defaults in the postwar period. In 1989, however, a major commercial paper issuer defaulted on $213 million of outstanding paper, and two funds held enough of the issuer's paper to jeopardize their ability to maintain a $1 share value. The funds' advisors averted the possibility of a decline in the $1 share value by purchasing the paper in question from the funds. In 1990 two additional issuers defaulted on their commercial paper, which was held by a number of money funds. Once again, the funds' advisors came to the rescue by purchasing the paper in question from the funds.

In reaction to these events, the SEC in 1991 tightened the risk-limiting rules governing the credit quality, diversification, and maturity of taxable MMFs that wished to use the amortized cost or penny-rounding accounting methods. Most importantly, the SEC decided that a firm following these procedures had to invest 95 percent of its assets in "First Tier" securities, which generally speaking was defined to include Treasury securities or privately issued securities rated A1-P1, and had to invest the remainder in "Second Tier" securities rated A2-P2.[6] The SEC also required that a fund invest no more than 1 percent of its assets in

[6] Crabbe and Post (1992) document the decline in MMFs' holding of A2-rated paper following the imposition of this regulation and conclude that the regulation raised the interest rate on A2 paper relative to the rate on A1 paper.

any particular Second Tier company or 5 percent of its assets in any First Tier company.[7] Finally, the SEC lowered the average maturity requirement from 120 to 90 days.

All MMFs wishing to use the amortized cost or penny-rounding accounting methods were required to follow the SEC's new rules on maturity. Tax-exempt funds, however, were exempted from the restrictions on Second Tier investment and from the 5 percent diversification test. The exemption was based on the view that some of these funds often would have difficulties meeting the tests because of the limited number of tax-exempt issuers available to them (for example, state-specific funds).

In addition to revising the risk-limiting rules, the SEC in 1991 made it unlawful for any mutual fund to use the term "money market" or any similar term as part of its name or to hold itself out to investors as a money market fund unless it met the risk-limiting conditions of Rule 2a-7. This provision effectively defined a money market fund as a mutual fund that follows the risk-limiting provisions of Rule 2a-7. Finally, in order to increase investor awareness that investing in a money market fund is not without risk, the SEC required that the cover page of a money market fund prospectus prominently disclose that the MMF's shares are neither insured nor guaranteed by the U.S. government and that there is no assurance that the funds will be able to maintain a stable value of $1 per share.

Expenses and Waivers Virtually all MMFs are no-load mutual funds in which investors purchase and redeem shares without paying a sales charge. Expenses of the funds are instead deducted daily from gross income before shareholder dividends are declared. The difference between the yield earned on an MMF's assets and the yield earned by shareholders is the MMF's expense ratio (defined as the ratio of total expenses on an annual basis to average assets). Institutional funds typically have lower expense ratios than other funds because of their much higher average balances. In the fourth quarter of 1992 the average expense ratio was 0.36 percent for institutional taxable funds and 0.74 percent for other taxable MMFs.[8] The expense ratios for tax-exempt funds were 0.40 percent for institutional funds and 0.64 percent for other funds. These averages mask a wide variation in individual fund expense ratios, which range from as little as 0.2 percent to 1.0 percent or more.

Typically, the largest MMF expense is the management fee charged by the fund's advisor, which is usually also the sponsor of the fund. This fee compensates the fund's advisor for administering the fund and managing its portfolio.

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[7] The Investment Company Act of 1940 has a 5 percent diversification requirement with respect to 75 percent of a mutual fund's assets, but no diversification requirement with respect to 25 percent of its assets. The effect of this provision of the 1991 amendment to Rule 2a-7 was to expand the 5 percent diversification requirement to the entire portfolio of taxable MMFs.

[8] Lipper Directors' Analytical Data, Lipper Analytical Securities, December 1992.

Another fee charged by many MMF advisors is the so-called "12b-1" fee (named after an SEC rule) that reimburses the fund's sponsor for the advertising and marketing costs associated with distributing shares. Other MMF operating expenses cover the custody of securities and transactions and communications with shareholders.[9] In addition to operating expenses, MMFs pay various registration fees and taxes and incur other expenses resulting from government regulations and requirements, such as auditing expenses and directors' fees.

The sponsors of many MMFs waive part of the fund's expenses to keep the expense ratio charged to the funds' shareholders to an acceptable level. In some cases the expense waiver is part of an explicit commitment by the MMF's sponsor to place a limit on the expenses of the funds absorbed by shareholders. In other cases the waiver is an informal management arrangement that may be terminated by the sponsor at any time. In reports to shareholders the waiver is often couched in terms of the sponsor "foregoing" part of its management fee. In some instances, the sponsor not only foregoes all of the management fee but also absorbs other expenses of the funds.

Most small MMFs waive part of their funds' expenses in order to compete more effectively with larger funds. Economies of scale are present in the MMF industry which means that average costs of small funds are higher than average costs of large funds.[10] By waiving some expenses, fund sponsors can offer shareholders yields that are more competitive with those offered by the larger funds. To the extent that this approach attracts new shareholders, a small MMF can grow to an asset level where its costs can be fully passed on to shareholders.

Some fund sponsors waive a significant portion of their fund's expenses even after the fund has reached a large size, although eventually they eliminate most, if not all, of the waiver. By providing the waiver for an extended period of time in the early years of a fund's life, the fund is able to offer unusually high yields and attract shareholders who it believes are likely to stay with the funds even after the waiver is eliminated. Some advisors may also view their MMF as a "loss leader" to attract investors to other funds in their fund group.

SHORT-TERM INVESTMENT FUNDS

Short-term investment funds (STIFs) are collective investment funds operated by bank trust departments. A collective investment fund is an arrangement whereby the monies of different accounts in the trust department are pooled to purchase a certain type of security, such as common stocks, corporate bonds, tax-exempt

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[9] Cook and Duffield (1979a) provide a detailed breakdown and discussion of MMF expenses.

[10] In a study of MMF costs using data from 1977 and 1978, Cook and Duffield (1979a) find that average costs of MMFs decline as assets increase, at least up to asset levels of $50 million. (This would be roughly equal to $100 million in 1992 dollars.)

bonds, or, in the case of STIFs, short-term securities. STIFs function exactly like MMFs and offer the same advantages to holders of trust department accounts. In particular, the minimum investment is usually a negligible amount and funds can be invested and withdrawn without transactions fees.

The first STIF appears to have been started in 1968. By the end of 1974 there were over 70 STIFs with total assets of almost $3 billion. STIFs began to grow rapidly when interest rates rose in the late 1970s, and by the end of 1979 there were 250 STIFs with over $32 billion in assets. STIFs continued to grow in the 1980s, and at the end of 1991 there were 318 STIFs with total assets of $144 billion.

Most bank trust departments without STIFs use MMFs for their trust accounts. The decision to set up a STIF or to use an MMF is largely dependent on the size of the trust department. The larger the trust department the more likely it is to have a STIF.[11]

Regulations on the portfolio of STIFs set by the Comptroller of the Currency require that (1) at least 80 percent of investments be payable on demand or have a maturity not exceeding 91 days and (2) not less than 20 percent of the value of the fund's assets be composed of cash, demand obligations, and other assets that mature on the fund's next business day. As a result of these regulations, STIFs hold a substantial amount of variable-amount notes (also called master notes), which are a type of open-ended commercial paper that allows the investment and withdrawal of funds on a daily basis and pays a daily interest rate tied to the current commercial paper rate. In addition, STIFs hold a large amount of standard commercial paper.

Most STIFs fall into two broad categories. The first is for the accounts of personal trusts and estates. These STIFs receive tax-exempt status under the condition that income earned by the fund is distributed to participating account holders. The second type of STIF is for the accounts of employee benefit plans that are exempt from taxation under the Internal Revenue Code. Under IRS regulations monies of these tax-exempt employee benefit accounts cannot be mixed with monies of personal trust and estate accounts. Hence, if a bank trust department wishes to provide STIF services to both types of accounts, it must establish two separate STIFs.

Table 3 shows the aggregate numbers and total assets of each type of STIF as of year-end 1991. At that time 205,314 personal trust accounts had a total of $16.4 billion invested in STIFs, while 69,743 employee benefit accounts had a total of $119.4 billion invested in STIFs. There was also a small amount of funds invested in STIFs for charitable and other accounts.

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[11] American Bankers Association (1979, pp. 16 and 22) and Cook and Duffield (1979b, p. 22) present survey data from two different sources that document this relationship.

TABLE 3

Assets of Short-Term Investment Funds

(Year-End 1991)

	No. of Funds	No. of Banks	Assets ($ billions)	Total Accounts
Personal trust	89	63	16.4	205,314
Employee benefit	185	98	119.4	69,743
Keogh	12	10	0.1	2,393
Charitable trust	4	3	1.1	384
Others	28	19	7.0	13,724
TOTAL	318	127*	144.0	291,558

* Total does not equal sum because some banks have more than one type of STIF.
Source: 1991 Survey of Trust Assets of Financial Institutions.

In recent years some banks have converted their STIFs into MMFs. Conversion permits the bank to sell shares in the fund to a broader range of customers both inside and outside the bank. Moreover, conversion enables a bank interested in starting an MMF to do so quickly with a large enough customer base that it can operate profitably.

LOCAL GOVERNMENT INVESTMENT POOLS

Local government investment pools (LGIPs) are investment pools set up by individual states to enable local government entities—such as counties, cities, school districts, state agencies, etc.—to purchase shares in a large portfolio of money market instruments.[12] The primary purpose of state legislation establishing these pools has been to encourage efficient management of idle funds. Most pools are administered by the state treasurer's office, often in conjunction with the state investment board and a local government advisory council. In some exceptions to this general pattern, private organizations provide advisory and administrative services, usually under the sponsorship of the state or an association of local governments. For instance, the Illinois LGIP is administered by a bank trust department, and LGIPs in Massachusetts, North Carolina and Pennsylvania are run by investment management firms.

In most respects the operating characteristics of LGIPs are identical to those of MMFs. Funds may be invested by wire or check and withdrawn either by telephone request (with payment sent by wire) or by check. Funds may generally

[12] Most states do not permit investment by localities in MMFs. A few states, however, allow their local units to purchase shares in MMFs whose investments meet the state's legal list of acceptable investments for localities. See Maynard and Wheatley (1986).

be invested and withdrawn on a daily basis. Interest is earned daily net of the pool's expenses.

The first LGIPs were established in the early 1970s by Connecticut, Illinois, Montana, and Utah. By 1991 at least 28 states had established LGIPs. Table 4 provides summary data on various characteristics of 22 of these funds. As of June 1991 these LGIPs had 15,286 government units investing a total of $45.4 billion. Participation by eligible government units within a particular state is highly variable, ranging from as low as 12 percent to as high as 79 percent. LGIPs also follow widely differing maturity strategies. While many have average maturities as short as those of MMFs, some have average maturities of several months.

TABLE 4

LGIP Statistics

(June 1991)

Pennsylvania

			Participants		
	Assets ($ millions)	**Average Maturity (days)**	**No. of Active**	**Percent of Potential**	**Established**
Arizona	1,200	93	127	42.2	1980
California	7,273	201	1,766	40.8	1977
Colorado	726	31	635	31.8	1985
Connecticut	2,070	140	100	52.9	1972
Florida	7,303	116	538	59.1	1977
Georgia	1,074	84	174	13.5	1981
Idaho	252	63	673	63.3	1981
Illinois	1,176	13	3,273	49.4	1974
Massachusetts	1,357	75	659	78.9	1977
Montana	769	85	212	17.0	1973
New Jersey	6,900	118	611	37.6	1978
New Mexico	166	29	62	18.6	1988
North Carolina	1,448	44	496	54.2	1982
Ohio	1,663	116	1,352	40.0	1986
Oregon	1,566	156	763	50.8	N/A
1,215	61	1,660	33.5	1981	
Tennessee	888	213	250	27.7	1979
Texas	2,517	117	423	12.1	1989
Utah	1,474	109	333	62.9	1974
Virginia	372	19	254	59.1	1981
Washington	1,545	49	234	13.2	1986
Wisconsin	2,476	288	691	25.5	N/A
TOTAL	45,430		15,286		

Source: Survey of LGIPs by Fidelity Investments, Boston.

CONCLUSION

Short-term investment pools revolutionized the money market by providing virtually all investors access to money market investments. When MMFs and other STIPs first emerged in the mid-1970s, a widespread view was that they were solely a reaction to interest rate ceilings at depository institutions and that they would disappear after these ceilings were removed. Time has proved this view incorrect, as STIPs have continued to grow rapidly even in the absence of these ceilings. This growth reflects the ability of STIPs to offer competitive money market yields and their widespread use in conjunction with other products offered by mutual fund groups, brokerage companies, and bank trust departments.

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Chapter 13
BEHIND THE MONEY MARKET: CLEARING AND SETTLING MONEY MARKET INSTRUMENTS

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Whenever a money market instrument is traded, some means must exist for transferring the instrument and for making payment. In other words, there is a necessity for clearing and settling the trade, tasks that are usually referred to as operational, or back-office, functions.

Clearing refers to processing a trade and establishing what the parties to the trade owe each other. Settlement refers to the transfer of value between the parties so the trade is completed (Group of Thirty 1989, p. 35). The first step in the clearing and settlement process involves conveying the details of the trade from traders to the back office. Second, the details must be compared and matched between the buyer and seller to ensure that both buyer and seller agree on what is to be traded and on what terms. Failure to do so might lead to delivery problems. This chapter will focus on what happens next: determination of the obligations between the parties and settlement of the trade.

Clearing and settlement systems link the participants in the money market. This chapter uses examples to describe how clearing and settlement take place for various types of money market instruments.[1] In addition, it discusses risks inherent in clearing and settlement, and the steps being considered to reduce such risks.

WHERE BANKS FIT IN

Banks and the interbank payment system are at the center of the clearing and settlement mechanism for the money market. Banks connect the participants in the money market by acting in three capacities. First, they act as agents for issuers of money market instruments, which means they perform the physical tasks of issuing and redeeming instruments in the market and of maintaining registration records. Second, they act as custodians of instruments, which involves

[1] For a more detailed description of the operational side of the money market, the reader should consult Marcia Stigum's treatment in *After the Trade*.

safekeeping them as a service to investors. Like valuables kept in a safe-deposit box, instruments entrusted to a custodian bank do not show up on the bank's balance sheet as either assets or liabilities because they remain the property of their owners.

Finally, and most importantly, some banks specialize in clearing. A clearing bank is responsible for transferring securities from one party to another and for transferring payment for the securities. Dealers maintain two types of accounts at clearing banks: securities accounts and funds accounts. When a clearing bank is instructed to transfer securities from Dealer A's securities account to that of Dealer B, the bank also transfers payment for the securities from Dealer B's funds account to that of Dealer A. If the dealers do not use the same clearing bank, then the transaction involves a transfer of securities and funds between two banks.

Transfers between banks take place at the hub of the money market, the interbank payment system. Even when instruments are cleared outside the banking system, as is the case when a dealer firm clears for itself, payment takes place through banks. The payment system, which links banks to each other, includes both paper checks and electronic funds transfer, although almost all interbank payments now occur electronically over wholesale wire transfer networks.[2]

The main wholesale wire transfer network in the United States is Fedwire, which operates through bank reserve accounts at the 12 Federal Reserve Banks. Fedwire can be used to transfer both funds and book-entry U.S. government securities (to be described presently) between banks and other depository institutions. During 1991, about 260,000 Fedwire funds transfers totaling about $766 billion occurred on an average day. Mean transfer size was about $3 million. In addition, over 44,000 book-entry securities transfers amounting to about $476 billion occurred daily. The average book-entry transfer was about $10.8 million.

Table 1 shows how Fedwire is used to complete a federal funds transaction. Assume that Bank of Downtown finds itself with $10 million of excess reserves while Midtown Trust is $10 million short of required reserves. A broker matches the two and arranges for Downtown to sell (lend) $10 million to Midtown, so Downtown's excess reserves will be used to fund Midtown's shortage. Settlement of the transaction will occur through reserve accounts at their Federal Reserve Bank.[3] When Downtown initiates the transfer, its reserve account at the Fed is reduced by $10 million. Within a split second, Midtown's reserve account is increased by the same amount. Once made, the Fedwire payment is final and irrevocable. Notice that on the books of the Fed the transfer simply moves reserves from the account of one bank to that of the other. The next day, Midtown uses Fedwire to repay the funds and essentially reverses the process.

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[2] Wholesale wire transfer networks link banks with each other. In contrast, retail wire transfer systems, such as automated teller machine networks, link banks with consumers.

[3] If the two banks are in separate Federal Reserve districts, the transaction will involve accounts at two different Federal Reserve Banks.

TABLE 1

Fedwire Message Between Banks

(in millions of dollars)

Bank of Downtown		Federal Reserve Bank		Midtown Trust	
Assets	**Liabilities**	**Assets**	**Liabilities**	**Assets**	**Liabilities**
Reserves -10			Reserves, Downtown -10 Reserves, Midtown +10	Reserves +10	

An important feature of Fedwire transfers is that they are settled on a bilateral, trade-for-trade basis, also known as gross settlement. If, instead, transfers were consolidated into net positions between banks or between banks and the network in order to reduce the actual number of interbank transfers that take place, the system would be called a netting system (see box, "Netting and Net Settlement"). Netting can take two forms. Bilateral netting combines gross obligations between banks into net obligations so each pair of banks in a system exchanges only one settlement payment. Multilateral netting combines each bank's bilateral net positions into "net net" obligations between the bank and the other banks in the system. When settlement occurs, each bank is either a net creditor (one that is owed money by the rest of the system) or a net debtor (one that owes money).

The Clearing House Interbank Payments System (CHIPS) is a multilateral netting system. It is owned and operated by the New York Clearing House, a private organization. CHIPS transfers only funds and not securities, and is used largely, although by no means exclusively, in connection with international transactions such as Eurodollars and foreign exchange (Clair 1991). During 1991 approximately 150,000 transfers totaling about $866 billion took place on an average day on CHIPS. Average transfer size was $6 million. At the end of 1991, 126 depository institutions, many of them branches of foreign banks, participated in CHIPS.

CHIPS is organized in a hierarchical fashion whereby a subset of participating banks (20 out of 126) settle directly with CHIPS while the others must settle on the books of one of the settling banks. Settlement occurs at the end of the day, when settling banks in net debit positions send (over Fedwire) the funds they owe to a special CHIPS net settlement account at the Federal Reserve Bank of New York. CHIPS then wires funds from the account to settling banks in net

NETTING AND NET SETTLEMENT

In order to understand how netting and net settlement work, consider the example of the four banks in Table 2, each of which sends a payment message to each of the other three banks. Bank of Downtown sends transfer messages for $10 million to Midtown Trust, $10 million to Crosstown National Bank, and $10 million to Outatown Bank; Midtown sends $10 million to Downtown, $10 million to Crosstown, and $40 million to Outatown; and so on for a total of 12 separate payments. On a gross settlement system like Fedwire, each of the 12 payment transactions would be settled separately.

If, instead, each bank's obligations to each of the other banks were combined, that is, netted bilaterally, then the result would be the net positions in the first four columns of Table 3. In such a netting system, each bank (read from the left of the matrix) would be in a net credit or net debit position versus each of the other banks (read from the top of the matrix), and settlement would take place when the banks send net payments to or receive net payments from each of the other banks at the end of the day. Since Downtown sent a payment message for $10 million to Crosstown but received one from Crosstown for $40 million, Downtown will have a net credit of $30 million versus Crosstown (which, correspondingly, has a net debit of $30 million against Downtown). Midtown will send $20 million to Outatown; Crosstown will send $30 million to Downtown, $20 million to Midtown, and $10 million to Outatown; and Outatown will send $10 million to Downtown. Since Downtown's and Midtown's payments to each other cancel out, neither will have to send a payment to the other.

Multilateral netting takes the netting process one step further by combining the bilateral net positions for each bank into a net position versus the network. The network adds up the amounts each owes to and is owed by the other banks (obtained by summing the net positions in a bank's row of the matrix). This results in the net net positions shown in the last column of the matrix: Downtown has a net credit of $40 million coming in, Crosstown has a net debit of $60 million going out, Outatown has a net credit of $20 million, and Midtown's incoming funds are offset by its outgoing funds. Settlement occurs when Crosstown sends the network $60 million and the network wires $40 million to Downtown and $20 million to Outatown.

Moving to bilateral netting and then to multilateral netting can mean substantial reductions in the number of actual exchanges between participants. In Table 2 the gross number of transactions is 12 but the number could be far more. By moving to bilateral netting, the number of exchanges of funds is reduced to a maximum of six or, more generally,

$$n(n - 1) / 2,$$

where n is the number of participating institutions. By moving to multilateral netting, the maximum number of exchanges is reduced to n, which in the example is four. Such reductions in the number of exchanges can mean reductions in operational costs and risk exposures between institutions. For specific examples of how risks can both arise in and be avoided by netting, see Gilbert (1992).

TABLE 2
Payment Messages
(in millions)

Sender	Receiver	Amount
Downtown	Midtown	$10
Downtown	Crosstown	$10
Downtown	Outatown	$10
Midtown	Downtown	$10
Midtown	Crosstown	$10
Midtown	Outatown	$40
Crosstown	Downtown	$40
Crosstown	Midtown	$30
Crosstown	Outatown	$20
Outatown	Downtown	$20
Outatown	Midtown	$20
Outatown	Crosstown	$10

TABLE 3
Net Bilateral and Net Multilateral Settlement Obligations
(in millions)

	Downtown	Midtown	Crosstown	Outatown	Net Net
Downtown		$0	$30	$10	$40
Midtown	$0		$20	($20)	$0
Crosstown	($30)	($20)		($10)	($60)
Outatown	($10)	$20	$10		$20

Note: Numbers in parentheses denote a net debit; those not in parentheses, a net credit.

credit positions. The special account starts out with a zero balance and, when settlement is complete, ends with a zero balance; the CHIPS account is used for nothing else.

The results of a 1987 survey of New York banks highlight the international character of CHIPS payments relative to Fedwire payments (Federal Reserve Bank of New York 1987-88). According to the survey, 55 percent of the dollar amount of CHIPS payments was related to foreign exchange transactions; on Fedwire, foreign exchange transactions were negligible. Further, 28 percent of CHIPS dollar value was related to Eurodollar placements; on Fedwire, such transactions were 10 percent of dollar value. Finally, 34 percent of Fedwire dollar value was for federal funds transactions; on CHIPS, the percentage was almost zero.

One last network deserves mention because of its role in international payments. The Society for Worldwide Interbank Financial Telecommunication (SWIFT) is a nonprofit cooperative chartered under Belgian law and owned by 1,885 participating institutions in 73 countries, including the United States. Unlike Fedwire or CHIPS, SWIFT is not a funds transfer system. Instead, SWIFT payment messages instruct banks to transfer funds by means of accounts at correspondent banks.[4] Such a transfer might involve transfers among accounts at the same bank. For example, suppose Bank of Downtown serves as correspondent bank for both Midtown Trust and London Bank and that London Bank wishes to make a payment to Midtown Trust. London makes the payment by sending a SWIFT message instructing Downtown to reduce London's correspondent account and to increase Midtown's by the amount of the payment. Alternatively, a SWIFT message might direct that a payment be made between banks. If London wishes to make a payment to Crosstown National, for example, but Crosstown does not have a correspondent relationship with Downtown, then London's SWIFT message would instruct Downtown to transfer funds (from London's correspondent account) to Crosstown by means of an interbank network like Fedwire or CHIPS.

FORMS OF MONEY MARKET INSTRUMENTS

The form in which a money market instrument is issued and traded largely determines the manner in which it is cleared and settled. Because federal funds are essentially exchanges of bank reserves between accounts at Federal Reserve Banks, they are settled by means of Fedwire transfers. For other money market instruments, how they are cleared and settled depends on whether they are traded in physical (also called "definitive") form or book-entry form. Trades of physical securities may require that paper instruments move between institutions, while trades of book-entry securities only involve changes in computer account entries.

Physical Securities At present, bankers acceptances, large certificates of deposit (CDs), and some commercial paper issues are issued in physical form; that is, they use paper certificates to represent the obligation of the issuer to the purchaser. Clearing physical securities works as follows. Suppose Hoozon First Securities decides to purchase $10 million of CDs from Watson Second Securities. Suppose also that Hoozon uses Downtown as its clearing bank and Watson uses Midtown. After the securities firms' back offices notify their clearing banks of the trade, Midtown pulls the CDs from the vault and a courier delivers them to Downtown. Downtown then sends over Fedwire $10 million in payment to Midtown. Downtown charges Hoozon for the payment while Midtown credits

[4] Correspondent banks perform services for other banks in return for fees or minimum deposit balances.

Watson. The trade between the dealers has been cleared and settled. If Hoozon then sells $5 million of the CDs it bought to Zippi Industries, one of its corporate customers, and if Crosstown National serves as Zippi's custodian bank, it will be necessary for Downtown to deliver the securities to Crosstown for safekeeping and for Crosstown to make a payment to Downtown.

A dealer might elect to clear securities itself. In the above example, self-clearing would mean that securities would be moved directly between the dealers (or between a self-clearing dealer and a clearing bank). Whether a dealer clears for itself or uses a bank depends on whether or not the additional costs of running a clearing operation outweigh the benefits of possibly faster clearing and greater control over the operation. But even if a dealer clears for itself, it will still use a bank for settlement because only banks (or, more accurately, depository institutions) have accounts at the Federal Reserve.[5]

Physical securities by their nature involve handling and delivery costs as well as risks of theft. Consequently, there are incentives for keeping (or "immobilizing") physical securities in depositories instead of requiring that the securities be physically moved each time they are traded. When a security held in a depository is sold, the depository's files are updated to reflect the change of ownership. In other words, a depository effectively converts an exchange of physical securities into an exchange of book-entry securities (McAndrews 1992). Taking the process one step further, the physical security can be eliminated altogether (or "dematerialized"), and the security can be issued, cleared, settled, and redeemed in book-entry form on the computer files of the depository. As more types of money market instruments become eligible for conversion to book-entry form, cost considerations could quickly turn physical securities into an anachronism.

Book-Entry Securities Money market instruments have been moving from physical to book-entry form by means of depositories. In particular, the Depository Trust Company (DTC), a New York limited-purpose trust company owned jointly by banks, broker-dealers, and other financial organizations, has been active in making more instruments eligible for conversion to book-entry form. The movement to book entry has been rapid. Municipal securities became eligible for book entry in 1981; by the end of 1991, 77 percent of the value of municipal notes outstanding was issued through DTC in book-entry form and involved no physical securities (DTC 1991). Commercial paper became eligible for book entry in 1990; by May 1992, 42 percent of the value of the commercial paper market was issued through DTC entirely in book-entry form. And as of this writing, DTC was attempting to make large CDs and bankers acceptances eligible for book entry.

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[5] A dealer could avoid using banks for settlement if it physically delivered cash in payment for securities. Transportation costs and theft risks ensure that virtually all payments take place through banks.

U.S. government securities, including Treasury bills, are now issued only in book-entry form. That is, instead of being represented by paper certificates, obligations of the United States are now recorded as entries on the computer files of the Federal Reserve Banks and commercial banks. The Treasury and Federal Reserve System completed a switch to book-entry securities in 1986 because of concerns about security and the costs of processing and moving huge quantities of paper instruments.

Every Treasury security issue is represented by an entry on a Federal Reserve Bank's computer. The Fed keeps track of which bank holds a particular portion of an issue and, at maturity, transfers funds in repayment to the bank holder. But while the Fed maintains securities accounts in order to keep track of the outstanding issue balance, the accounts do not show up on the Fed's balance sheet. Rather, they reflect the Fed's custody of the Treasury security issue for the various depository institutions. Similarly, when a bank purchases a Treasury security for the account of a customer, the bank is not the actual owner even though the Fed's computer assigns a security balance to that bank.

Now for a transaction. Say that the Bank of Downtown purchases $10 million of Treasury bills from Midtown Trust. When the securities are transferred over Fedwire, two offsetting transactions take place simultaneously: the exchange of securities and the exchange of funds in payment. The movement of Treasury bills takes place by decreasing Midtown's book-entry securities account at the Federal Reserve Bank and by increasing Downtown's by the same amount. Payment occurs as shown in Table 1 and involves a transfer of funds from Downtown's reserve account to Midtown's. Because funds and securities are transferred at the same time, such a system is called a "delivery versus payment" system.

The preceding example only shows what would happen if the purchasing bank were holding the securities for its own account. Now, suppose that Hoozon First Securities purchases the $10 million of Treasury bills from Watson Second Securities. If Hoozon uses Downtown as its clearing bank and Watson uses Midtown, Downtown increases Hoozon's securities account by $10 million and decreases its funds account by the same amount in payment. At the other end, Midtown decreases Watson's securities account and increases its funds account by $10 million. On Fedwire the securities move from Midtown to Downtown and the payment moves in the opposite direction. Note that actual ownership of the security moves from Watson to Hoozon and does not rest with either bank. The banks and the Federal Reserve are simply the conduit through which ownership of securities is passed.

EURODOLLARS

Trades involving Eurodollar deposits differ from those of domestic instruments in that they entail corresponding transactions in the United States and overseas and also are likely to involve the CHIPS and SWIFT networks. Eurodollar deposits

are dollar deposits held outside the United States in either a foreign bank or an overseas branch of a U.S. bank. Inside the United States, Eurodollars can be held only by international banking facilities of domestic or foreign banks. When Eurodollar deposits move between banks, they normally involve corresponding entries on the balance sheet of some organization located in the United States.

Table 4 shows an example in which the Bank of Downtown raises $10 million of interbank deposits from London Bank in the Eurodollar market; the transaction takes place through Downtown's London branch.[6] Because London Bank is not headquartered in the United States, any dollar-denominated transaction in which it engages must ultimately go through a correspondent bank in the United States. London uses Midtown Trust as a correspondent, so the transfer occurs through London's account at Midtown and then through Midtown's and Downtown's reserve accounts at the Federal Reserve Bank.

Once Downtown and London have agreed to the transaction, London sends Midtown a transfer message over the SWIFT network instructing that its balance with Midtown be decreased by the amount of the transfer. In carrying out the transfer of reserves to Downtown, Midtown would normally use the CHIPS network. The transaction is settled at the end of the day when CHIPS goes through net settlement and reserves are transferred from Midtown to Downtown.

There are specialized networks and facilities for clearing and settling other Eurodollar instruments. For example, Euro commercial paper, Euro-notes, and Eurodollar CDs are commonly cleared and settled in both the Euroclear and CEDEL systems. Euroclear, originally formed to clear Eurobond trades, is owned by a Belgian cooperative and operated under contract by the Brussels branch of Morgan Guaranty Trust Company. Securities are immobilized in a network of depositories and settled in book-entry form; funds transfers in connection with book-entry settlement take place through deposits on Morgan's books.

CEDEL is a Luxembourg corporation, specially chartered as a clearing organization. As with Euroclear, securities settled over CEDEL are immobilized in depositories; unlike Euroclear, funds transfers in connection with book-entry securities settlement take place through deposits with the CEDEL clearing organization itself.

Finally, Eurodollar instruments can be cleared and settled by banks. For example, the First National Bank of Chicago operates the First Chicago Clearing Centre in London in order to provide custodian, agent, and clearing bank services for Eurodollar instruments, primarily dollar-denominated CDs. Funds transfers associated with movements of Eurodollar instruments take place on the books of First Chicago's London branch.

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[6] The London branch's account with Downtown's headquarters bank in the United States is carried on the liability side of the U.S. bank's books as "due to" its branch and on the asset side of the London branch's books as "due from" its parent bank.

TABLE 4

Settlement of a Eurodollar Funds Purchase

(in millions of dollars)

Bank of Downtown, London Branch		London Bank (U.K.)		Bank of Downtown (U.S.)	
Assets	**Liabilities**	**Assets**	**Liabilities**	**Assets**	**Liabilities**
Account at U.S. office +10	Deposit, London Bank +10	Deposit, Midtown Trust -10 Deposit, Bank of Downtown +10		Reserves +10	London Branch account +10

Midtown Trust (U.S.)		Federal Reserve Bank	
Assets	**Liabilities**	**Assets**	**Liabilities**
Reserves -10	Deposits, London Bank -10		Reserves, Bank of Downtown +10 Reserves, MidtownTrust -10

RISK AND RISK CONTROLS[7]

Given the daily volume and value of transactions that occur in the money market, the opportunities for loss as the result of default or operational problems are potentially huge. Consequently, over the last decade both market participants and regulators have devoted a great deal of effort to formulating policies for keeping risks within acceptable limits.

Policy discussions often distinguish among several forms of risk (Parkinson et al. 1992). First, credit risk refers to potential losses arising from a clearing and settlement system participant defaulting on some or all of its settlement obligations. Second, liquidity risk arises from the possibility that settlement could be delayed because of temporary unavailability of funds. The distinction between credit risk and liquidity risk lies in the temporary nature of illiquidity as opposed to the permanent nature of default. Third, systemic risk refers to the danger that the failure of one participant to settle its obligations could lead to liquidity problems or settlement failure on the part of others. Finally, operational risk stems from the possible breakdown of computer systems or other elements of the clearing and settling mechanism.

Fedwire provides the most transparent example of credit risk. The Fedwire transaction shown in Table 1 omits an important point: In order for the transfer to take place, it is not necessary that the sending bank always have sufficient funds in its reserve account to cover the transfer.[8] If at the time of the transfer in Table 1 the Bank of Downtown has only $5 million on deposit as reserves, Downtown incurs a "daylight overdraft" of $5 million. That is, its reserve account is allowed to go negative during the day so long as the deficit is made up before close of business. Further, the receiving bank will have final payment at the time of the transfer regardless of whether the overdraft is ultimately covered. Until the overdraft is covered, the Federal Reserve Bank assumes the credit risk of Downtown's failing to provide the necessary funds. While credit risk has effectively been socialized by transferring it to the Fed, systemic risk has been eliminated because there is no avenue for losses to spread to other banks in the system.

On CHIPS, credit, liquidity, and systemic risks can all arise. For example, suppose the Bank of Downtown receives a CHIPS transfer message from Crosstown National for a payment to one of its corporate customers. Although CHIPS does not settle until the end of the day, it may be Downtown's practice to allow its customer to withdraw the funds prior to settlement. In allowing such access to funds, Downtown assumes the risk that Crosstown might fail to meet its net settlement obligation at the end of the day. More serious, the failure of Crosstown

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[7] For more comprehensive discussions, see Group of Thirty (1989), Juncker, Summers, and Young (1991), and Parkinson et al. (1992).

[8] Exceptions to this general rule include weak institutions whose overdrafts are either prohibited or monitored in real time.

to settle a particularly large net debit position could conceivably cause a chain reaction of settlement failures among other participants, some of which might depend on the receipt of payments from the failing bank in order to fund their obligations (Humphrey 1986). Measures to control such risk will be discussed presently.

Finally, operational risks may be illustrated with the following incident that occurred in 1985. The Bank of New York, acting as a clearing bank for book-entry Treasury securities, had an internal computer problem that allowed the bank to accept securities but not to process them for delivery to dealers, brokers, and other market participants. The bank's reserve account was debited for the amount of the securities, but the bank was unable to re-send them and collect payment. The result was a growing daylight overdraft in the Bank of New York's reserve account. As it became increasingly clear that the problem would not be fixed by close of business, the bank borrowed from the discount window. The problem was fixed during the night so the loan was repaid the following day.

As one might guess, the above risk categories overlap considerably. For example, operational problems at a bank could lead to liquidity problems, which in turn might cause systemic problems with other banks. In addition, operational problems could extend to accounting systems and thereby make it difficult for system participants to monitor their credit exposures to other participants. Finally, at the time a participant fails to meet its settlement obligations, the other participants are unlikely to be able to determine whether the problem is the result of default or illiquidity. Still, the distinctions are important to policymakers because each category of risk requires different solutions. For example, operational risks might lead to policies designed to create incentives to develop backup facilities and procedures to keep systems running, credit risks might suggest loss-sharing arrangements and limits on risk exposure, and liquidity risks might call for emergency lending arrangements.

Risk-control measures cover a wide spectrum. The simplest are membership standards, which seek to head off settlement problems by excluding from a system those participants lacking the financial strength and operational expertise to assure that settlement obligations can be met. Once a participant is admitted, the clearing organization should monitor the participant's financial condition to ensure that it does not pose losses to the other members.

Another form of risk control is quantitative limits on risk exposure. Examples include net debit caps and bilateral net credit limits. Net debit caps are limits on the size of a bank's combined daylight overdraft on Fedwire and net debit position on CHIPS. In other words, they attempt to control the risk a bank poses to the payment system by limiting how much a bank can, on balance, owe others over the wire transfer networks. Bilateral net credit limits specify the maximum net transfer a bank on CHIPS is willing to receive from a particular sending bank; that is, they provide a means for a bank to control its own exposure to other

banks. Net debit caps on Fedwire and CHIPS and bilateral net credit limits on CHIPS were part of the original Federal Reserve risk-control policy adopted in 1986.

Risks to a clearing and settlement system can also be limited by requiring system participants to put up collateral to cover their obligations to the system. If a participant defaults, the collateral is used to cover the losses. In effect, such a requirement amounts to a performance bond that a participant forfeits if it defaults on its settlement obligations.

A form of risk-control policy that seeks to create economic incentive to control risks is explicit pricing of daylight overdrafts (Mengle, Humphrey, and Summers 1987). The rationale for pricing is that it will impose a cost on using intraday credit and thereby provide incentives to reduce risk exposures and to more efficiently allocate intraday credit. In 1992 the Federal Reserve approved a charge on daylight overdrafts that exceed 10 percent of an institution's risk-based capital. By 1996 the charge will be $6.85 per day per $1 million (that is, an annual rate of 25 basis points) of average Fedwire daylight overdrafts arising from funds transfers and book-entry securities transfers that exceed 10 percent of an institution's risk-based capital.

A fifth form of risk-control policy is loss sharing among members of a net settlement system. Under a loss-sharing agreement, banks that are members of a system share the losses caused by another member's failure to settle. A loss-sharing agreement generally requires two characteristics to make it work. The first is settlement finality, that is, assurance that settlement entries will not be reversed in the event of one bank's failure to settle. Second, in order to make the loss-sharing agreement credible, banks are generally required to contribute collateral to a clearing fund, which can be drawn upon in the event of a settlement failure and can also serve as security for an emergency line of credit. By imposing costs on system participants if a failure occurs, a loss-sharing agreement can create incentives for banks to monitor the soundness of other banks in the system. CHIPS adopted settlement finality and a loss-sharing agreement in 1990.

A sixth means of risk control is obligation netting, that is, combining a set of offsetting gross payment of securities obligations into net obligations (see box, "Netting and Net Settlement"). Netting, be it bilateral or multilateral, can reduce operational risks by reducing the volume of transactions that actually pass through a clearing and settlement system. And provided that the underlying legal obligations between participants are netted along with the positions, netting can reduce credit risks between banks by reducing the total amount of funds and securities that actually must be transferred between banks (Gilbert 1992).

The Government Securities Clearing Corporations (GSCC) was established in 1986 to provide netting of government securities trades for banks and other securities brokers and dealers. It works as follows. Participants submit data on all securities transactions to be settled on a particular day. First, the trades are

compared. Then, each participant's transactions of each issue are added up into a net credit or debit security settlement position for each issue and a single funds settlement position. The netting process is the same as the multilateral arrangement shown in the box, except for GSCC the numbers would refer to sales or purchases of a specific issue of government securities instead of CHIPS funds transfers. Settlement occurs over the Fedwire book-entry system: Clearing banks deliver (against payment) net securities positions to GSCC; in turn GSCC sends (against payment) the netted amounts of each issue to receivers.

While netting can reduce operational risks as well as credit risk, it has the potential to increase systemic risk. In response to concerns about systemic risk, the GSCC has adopted three measures to deal with the default of a participant. First, GSCC requires that members contribute to a clearing fund. Second, it maintains a line of credit on which to draw in the event of liquidity problems. Finally, it has in place rules for sharing losses in the event of a default.

A final means of reducing risk, one that is applicable to systems for clearing and settling securities, is moving securities to book-entry, delivery-versus-payment form. Delivery versus payment helps reduce credit risk exposure because making the exchange of funds and securities simultaneous (or nearly so) eliminates (or greatly reduces) the time between delivery of securities and payment of funds during which a participant could fail to meet its obligation. In addition, book entry reduces operational risks by eliminating physical delivery of instruments.

While book entry and delivery versus payment reduce exposure to a defaulting participant, they do not eliminate it entirely. In order to provide additional protection against losses if a participant defaults, the Federal Reserve has issued guidelines for risk controls on privately operated book-entry systems (*Federal Register,* June 21, 1989). A specific example of such controls is in DTC's book-entry commercial paper facility. DTC's safeguards include a clearing fund contributed to by participants, net debit caps and a requirement that a participant maintain collateral on its net debit position (*Federal Register,* October 17, 1990).

To some extent designing a program for risk reduction entails trade-offs between various types of risk. For example, until 1981 CHIPS did not settle until the day after the transfer messages were made. That gave rise to overnight credit risk. When CHIPS moved to same-day settlement, credit risk was reduced (or made shorter in duration), but operational risk most likely increased, at least temporarily, since there was less time to prepare for settlement. In practice, the challenge in developing new clearing system technologies is to reduce credit and systemic risks while avoiding operational risks.

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Chapter 14
MONEY MARKET FUTURES

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INTRODUCTION

Money market futures are futures contracts based on short-term interest rates. Futures contracts for financial instruments are a relatively recent innovation. Although futures markets have existed over 100 years in the United States, futures trading was limited to contracts for agricultural and other commodities before 1972. The introduction of foreign currency futures that year by the newly formed International Monetary Market (IMM) division of the Chicago Mercantile Exchange (CME) marked the advent of trading in financial futures. Three years later the first futures contract based on interest rates, a contract for the future delivery of mortgage certificates issued by the Government National Mortgage Association (GNMA), began trading on the floor of the Chicago Board of Trade (CBT). A host of new financial futures have appeared since then, ranging from contracts on money market instruments to stock index futures. Today, financial futures rank among the most actively traded of all futures contracts.

Four different futures contracts based on money market interest rates are actively traded at present. To date, the IMM has been the site of the most active trading in money market futures. The three-month U.S. Treasury bill contract, introduced by the IMM in 1976, was the first futures contract based on short-term interest rates. Three-month Eurodollar time deposit futures, now one of the most actively traded of all futures contracts, started trading in 1981. More recently, both the CBT and the IMM introduced futures contracts based on one-month interest rates. The CBT listed its 30-day interest rate futures contract in 1989, while the Chicago Mercantile Exchange introduced a one-month LIBOR futures contract in 1990.

This chapter provides an introduction to money market futures. It begins with a general description of the organization of futures markets. The next section describes currently traded money market futuress contracts in some detail. A discussion of the relationship between futures prices and underlying spot market prices follows. The concluding section examines the economic function of futures markets.

AN INTRODUCTION TO FUTURES MARKETS

Futures Contracts Futures contracts traditionally have been characterized as exchange-traded, standardized agreements to buy or sell some underlying item on a specified future date. For example, the buyer of a Treasury bill futures contract—who is said to take on a "long" futures position—commits to purchase a 13-week Treasury bill with a face value of $1 million on some specified future date at a price negotiated at the time of the futures transaction; the seller—who is said to take on a "short" position—agrees to deliver the specified bill in accordance with the terms of the contract. In contrast, a "cash" or "spot" market transaction simultaneously prices and transfers physical ownership of the item being sold.

The advent of cash-settled futures contracts such as Eurodollar futures has rendered this traditional definition overly restrictive, however, because actual delivery never takes place with cash-settled contracts. Instead, the buyer and seller exchange payments based on changes in the price of a specified underlying item or the returns to an underlying security. For example, parties to an IMM Eurodollar contract exchange payments based on changes in market interest rates for three-month Eurodollar deposits—the underlying deposits are neither "bought" nor "sold" on the contract maturity date. A more general definition of a futures contract, therefore, is a standardized, transferable agreement that provides for the exchange of cash flows based on changes in the market price of some commodity or returns to a specified security.

Futures contracts trade on organized exchanges that determine standardized specifications for traded contracts. All futures contracts for a given item specify the same delivery requirements and one of a limited number of designated contract maturity dates, called settlement dates. Each futures exchange has an affiliated clearinghouse that records all transactions and ensures that all buy and sell trades match. The clearing organization also assures the financial integrity of contracts traded on the exchange by guaranteeing contract performance and supervising the process of delivery for contracts held to maturity. A futures clearinghouse guarantees contract performance by interposing itself between a buyer and seller, assuming the role of counterparty to the contract for both parties. As a result, the original parties to the contract need never deal with one another again—their contractual obligations are with the clearinghouse.

Contract standardization and the clearinghouse guarantee facilitate trading in futures contracts. Contract standardization reduces transactions costs, since it obviates the need to negotiate all the terms of a contract with every transaction—the only item negotiated at the time of a futures transaction is the futures price. The clearinghouse guarantee relieves traders of the risk that the other party to the contract will fail to honor contractual commitments. These two characteristics make all contracts for the same item and maturity date perfect substitutes for one another. Consequently, a party to a futures contract can always liquidate a futures commitment, or open position, before maturity through an offsetting transaction.

For example, a long position in Treasury bill futures can be liquidated by selling a contract for the same maturity date. The clearinghouse assumes responsibility for collecting funds from traders who close out their positions at a loss and passes those funds along to traders with opposing futures positions who liquidate their positions at a profit. Once any gains or losses are settled, the offsetting sale cancels the commitment created through the earlier purchase of the contract. Most futures contracts are liquidated in this manner before they mature. In recent years less than 1 percent of all futures contracts have been held to maturity, although delivery is more common in some markets.[1]

Forward agreements resemble futures contracts in that they specify the terms of a transaction to be undertaken at some future date. For this reason, the terms "forward agreement" and "futures contract" are often used synonymously. There are important differences between the two, however. Whereas futures contracts are standardized agreements, forward agreements tend to be custom-tailored to the needs of users. While a good deal of contract standardization exists in forward markets, items such as delivery dates, deliverable grades, and amounts can all be negotiated separately with each contract. Moreover, forward contracts are not traded on organized exchanges as are futures contracts and carry no independent clearinghouse guarantee. As a result, a party to a forward contract faces the risk of nonperformance by the other party. For this reason, forward contracting generally takes place among parties that have some knowledge of each other's creditworthiness. Unlike futures contracts, which can be bought or sold at any time before maturity to liquidate an open futures position, forward agreements are not transferable, as a general rule, and so cannot be sold to a third party. Consequently, most forward contracts are held to maturity.

Futures Exchanges In addition to providing a physical facility where trading takes place, a futures exchange determines the specifications of traded contracts and regulates trading practices. There are 13 futures exchanges in the United States at present. The principal exchanges are in Chicago and New York.

Each futures exchange is a corporate entity owned by its members. The right to conduct transactions on the floor of a futures exchange is limited to exchange members, although trading privileges can be leased to nonmembers. Members have voting rights that give them a voice in the management of the exchange. Memberships, or "seats," can be bought and sold: futures exchanges routinely make public the most recent selling and current offer price for a seat on the exchange.

Trading takes place in designated areas, known as "pits," on the floor of the futures exchange through a system of open outcry in which traders announce bids to buy and offers to sell contracts. Traders on the floor of the exchange

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[1] Based on data from the *Annual Report 1991* of the Commodity Futures Trading Commission.

can be grouped into two broad categories: floor brokers and floor traders. Floor brokers, also known as commission brokers, execute orders for off-exchange customers and other members. Some floor brokers are employees of commission firms, known as Futures Commission Merchants, while others are independent operators who contract to execute trades for brokerage firms. Floor traders are independent operators who engage in speculative trades for their own account. Floor traders can be grouped into different classifications according to their trading strategies. "Scalpers," for example, are floor traders who perform the function of marketmakers in futures exchanges. They supply liquidity to futures markets by standing ready to buy or sell in an attempt to profit from small temporary price movements.[2]

Futures Commission Merchants A Futures Commission Merchant (FCM) handles orders to buy or sell futures contracts from off-exchange customers. All FCMs must be licensed by the Commodity Futures Trading Commission (CFTC), which is the government agency responsible for regulating futures markets. An FCM can be a person or a firm. Some FCMs are exchange members employing their own floor brokers. FCMs that are not exchange members must make arrangements with a member to execute customer orders on their behalf.

Role of the Exchange Clearinghouse Each futures exchange has an affiliated exchange clearinghouse whose purpose is to match and record all trades and to guarantee contract performance. In most cases the exchange clearinghouse is an independently incorporated organization, but it can also be a department of the exchange. The Board of Trade Clearing Corporation, the CBT's clearinghouse, is a separate corporation affiliated with the exchange, while the CME Clearing House Division is a department of the exchange.

Clearing member firms act as intermediaries between traders on the floor of the exchange and the clearinghouse. They assist in recording transactions and assume responsibility for contract performance on the part of floor traders and commission merchants who are their customers. Although clearing member firms are all members of the exchange, not all exchange members are clearing members. All transactions taking place on the floor of the exchange must be settled through a clearing member. Brokers or floor traders not directly affiliated with a clearing member must make arrangements with one to act as a designated clearing agent. The clearinghouse requires each clearing member firm to guarantee contract performance for all of its customers. If a clearing member's customer defaults

[2] A good description of trading strategies employed by different floor traders can be found in Hieronymus (1971). In addition, detailed descriptions of different trading strategies can also be found in almost any good textbook on futures markets such as Chance (1989), Merrick (1990), or Siegel and Siegel (1990). Silber (1984) presents a comprehensive analysis of scalper trading behavior.

on an outstanding futures commitment, the clearinghouse holds the clearing member responsible for any resulting losses.

Margin Requirements Margin deposits on futures contracts are often mistakenly compared to stock margins. Despite the similarity in terminology, however, futures margins differ fundamentally from stock margins. Stock margin refers to a down payment on the purchase of an equity security on credit, and so represents funds surrendered to gain physical possession of a security. In contrast, a margin deposit on a futures contract is a performance bond posted to ensure that traders honor their contractual obligations, and not a down payment on a credit transaction. The value of a futures contract is zero to both the buyer and the seller at the time it is negotiated, so a futures transaction involves no exchange of money at the outset.

The practice of collecting margin deposits dates back to the early days of trading in time contracts, as the precursors of futures contracts were then called. Before the institution of margin requirements, traders adversely affected by price movements frequently defaulted on their contractual obligations, often simply disappearing as the delivery date on their contracts drew near. In response to these events, futures exchanges instituted a system of margin requirements, and also began requiring traders to recognize any gains or losses on their outstanding futures commitments at the end of each trading session through a daily settlement procedure known as "marking to market."

Before being permitted to undertake a futures transaction, a buyer or seller must first post margin with a broker, who, in turn, must post margin with a clearing agent. Margin may be posted either by depositing cash with a broker or, in the case of large institutional traders, by pledging collateral in the form of marketable securities (typically, Treasury securities) or by presenting a letter of credit issued by a bank. Brokers sometimes pay interest on funds deposited in a margin account.

As noted above, clearing member firms ultimately are liable to the clearinghouse for any losses incurred by their customers. To assure the financial integrity of the settlement process, clearing member firms must themselves meet margin requirements in addition to meeting minimum capital requirements set by the exchange clearinghouse.

Daily Settlement The practice of marking futures contracts to market requires all buyers and sellers to realize any gains or losses in the value of their futures positions at the end of each trading session, just as if every position were liquidated at the closing price. The exchange clearinghouse collects payments, called variation margin, from all traders incurring a loss and transfers the proceeds to those traders whose futures positions have increased in value during the latest trading session. If a trader has deposited cash in a margin account, his broker

simply subtracts his losses from the account and transfers the variation margin to the clearinghouse, which, in turn, transfers the funds to the account of a trader with an opposing position in the contract. Most brokers require their customers to maintain minimum balances in their margin accounts in excess of exchange requirements. If a trader's margin account falls below a specified minimum, called the maintenance margin, he faces a margin call requiring the deposit of additional margin money. In cases where collateral has been posted in the form of securities rather than in cash, the trader must pay the variation margin in cash. Should a trader fail to meet a margin call, his broker has the right to liquidate his position. The trader remains liable for any resulting losses.

Marking a futures contract to market has the effect of renegotiating the futures price at the end of each trading session. Once the contract is marked to market, the trader begins the next trading session with a commitment to purchase the underlying item at the previous day's closing price. The exchange clearinghouse then calculates any gains or losses for the next trading session on the basis of this latter price.

The following example involving the purchase of a Treasury bill futures contract illustrates the mechanics of the daily settlement procedure. Treasury bill futures prices are quoted as a price index determined by subtracting the futures discount yield (stated in percentage points) from 100. A 1 basis point change in the price of the Treasury bill contract is valued at $25.[3] Thus, if a trader buys a futures contract at a price of 96.25 and the closing price at the end of the trading session falls to 96.20, he must pay $125 (5 basis points x $25 per basis point) in variation margin. Conversely, the seller in this transaction would earn $125, which would be deposited to his margin account. The buyer would then begin the next trading session with a commitment to buy the underlying Treasury bill at 96.20, and any gains or losses sustained over the course of the next trading session would be based on that price.

Final Settlement Because buying a futures contract about to mature is equivalent to buying the underlying item in the spot market, futures prices converge to the underlying spot market price on the last day of trading. This phenomenon is known as "convergence." At the end of a contract's last trading session, it is marked to market one final time. In the case of a cash-settled contract, this final daily settlement retires all outstanding contractual commitments and any remaining margin money is returned to the traders. If the contract specifies delivery of the underlying item, the clearinghouse subsequently makes arrangements for delivery among all traders with outstanding futures positions. The delivery, or invoice price, is based on the closing price of the last day of trading. Any profit

[3]Price quotation and contract specifications for Treasury bill futures are discussed in more detail in the next section.

or loss resulting from the difference between the initial futures price and the final settlement price is realized through the transfer of variation margin. The gross return on the futures position is reflected in accumulated total margin payments, which must equal the difference between the final settlement price and the futures price determined at the time the futures commitment was entered into.

Regulation of Futures Markets The Commodity Futures Trading Commission is an independent federal regulatory agency established in 1974 to enforce federal laws governing the operation of futures exchanges and futures commission brokers. By law, the CFTC is charged with the responsibility to ensure that futures trading serves a valuable economic purpose and to protect the interests of users of futures contracts. The CFTC must approve all futures contracts before they can be listed for trading by the futures exchanges. It also enforces laws and regulations prohibiting unfair and abusive trading and sales practices.

The futures industry attempts to regulate itself through a private self-regulatory organization called the National Futures Association, which was formed in 1982 to establish and help enforce standards of professional conduct. This organization operates in cooperation with the CFTC to protect the interests of futures traders as well as those of the industry. As noted earlier, the futures exchanges themselves can be viewed as private regulatory bodies organized to set and enforce rules to facilitate the trading of futures contracts.

CONTRACT SPECIFICATIONS FOR MONEY MARKET FUTURES

Treasury Bill Futures The Chicago Mercantile Exchange lists 13-week Treasury bill futures contracts for delivery during the months of March, June, September, and December. Contracts for eight future delivery dates are listed at any one time, making the furthest delivery date for a new contract 24 months. A new contract begins trading after each delivery date.

Delivery Requirements The Treasury bill contract requires the seller to deliver a U.S. Treasury bill with a $1 million face value and 13 weeks to maturity. Delivery dates for T-bill futures always fall on the three successive business days beginning with the first day of the contract month on which (1) the Treasury issues new 13-week bills and (2) previously issued 52-week bills have 13 weeks left to maturity.[4] This schedule makes it possible to satisfy delivery requirements for a T-bill futures

[4] The Treasury auctions 13- and 26-week bills each Monday (except for holidays and special situations) and issues them on the following Thursday; 52-week bills are auctioned every four weeks. Auctions for one-year bills are held on a Thursday and the bills are issued on the following Thursday.

contract with either a newly issued 13-week bill or an original-issue 26- or 52-week bill with 13 weeks left to maturity. Deliverable bills can have 90, 91, or 92 days to maturity, depending on holidays and other special circumstances. The last day of trading in a Treasury bill futures contract falls on the day before the final settlement date.

Price Quotation Treasury bills are discount instruments that pay no explicit interest. Instead, the interest earned on a Treasury bill is derived from the fact that the bill is purchased at a discount relative to its face or redemption value. Treasury bill yields are quoted on a discount basis—that is, as a percentage of the face value of the bill rather than as a percentage of actual funds invested. Let S denote the current spot market price of a bill with a face value of $1 million. Then, the discount yield is calculated as

$$Yield = [(\$1{,}000{,}000 - S)/\$1{,}000{,}000](360/dtm),$$

where *dtm* refers to the maturity of the bill in days. As with other money market rates, calculation of the discount yield on Treasury bills assumes a 360-day year.

Treasury bill futures prices are quoted as an index determined by subtracting the discount yield of the deliverable bill (expressed as a percentage) from 100:

$$Index = 100 - Futures\ Discount\ Yield.$$

Thus, a quoted index value of 95.25 implies a futures discount yield for the deliverable bill of 100 - 95.25 = 4.75 percent. This convention was adopted so that quoted prices would vary directly with changes in the future delivery price of the bill.

Final Settlement Price The final settlement price, also known as the delivery price or invoice cost of a bill, can be expressed as a function of the quoted futures index price using the formulas given above. For a bill with a face value of $1 million, the resulting expression is

$$S = \$1{,}000{,}000 - \$1{,}000{,}000(100 - Index)(0.01)(dtm/360),$$

where (100 - *Index*)(0.01) is just the annualized futures discount yield expressed as a decimal. The CME determines the days to maturity used in this formula by counting from the first scheduled contract delivery date, regardless of when actual delivery takes place. This means that calculation of the invoice cost is based on an assumed 91-day maturity, except in special cases where holidays interrupt the regular Treasury bill auction and delivery schedules.

To illustrate, suppose that the final index price of a traded contract is 95.25 and the deliverable bill has 91 days to maturity as of the first scheduled delivery date. Then, the final delivery price would be

$$\$987{,}993.06 = \$1{,}000{,}000 - \$1{,}000{,}000(0.0475)(91/360).$$

Minimum Price Fluctuation The minimum price fluctuation permitted on the trading floor is 1 basis point, or 0.01 percent. Thus, the price of a Treasury bill futures contract may be quoted as 95.25 or 95.26, but not 95.255. The exchange values a 1 basis point change in the futures price at $25. Note that this valuation assumes a 90-day maturity for the deliverable bill.

Three-Month Eurodollar Time Deposit Futures Three-month Eurodollar futures are traded actively on three exchanges at present. The IMM was first to list a three-month Eurodollar time deposit futures contract in December of 1981. Futures exchanges in London and Singapore soon followed suit by listing similar contracts. The London International Financial Futures Exchange (LIFFE) introduced its three-month Eurodollar contract in September of 1982, while the Singapore International Monetary Exchange (SIMEX) introduced a contract identical to the IMM contract in 1984. A special arrangement between the IMM and SIMEX allows for mutual offset of Eurodollar positions initiated on either exchange. Thus, a trader who buys a Eurodollar futures contract at the IMM can undertake an offsetting sale on SIMEX after the close of trading at the IMM.[5] The Tokyo International Financial Futures Exchange began listing a three-month Eurodollar contract in 1989, but that contract is not traded actively at present. The IMM contract remains the most actively traded of the different Eurodollar contracts by a wide margin.

The IMM Eurodollar contract is the first futures contract traded in the United States to rely exclusively on a cash settlement procedure. Contract settlement is based on a "notional" principal amount of $1 million, which is used to determine the change in the total interest payable on a hypothetical underlying time deposit. The notional principal amount itself is never actually paid or received.

Expiration months for listed contracts are March, June, September, and December. A maximum of 20 contracts are listed at any one time, making the furthest available delivery date 60 months in the future.

Contract Settlement When a futures contract contains provisions for physical delivery, market forces cause the futures price to converge to the spot market price as the delivery date draws near. Actual delivery of the underlying item never takes place with a cash-settled futures contract, however. Instead, the futures exchange forces the process of convergence to take place by setting the final settlement price equal to the spot market price prevailing at the end of the last day of trading. Final settlement is achieved by marking the contract to market one last time based on the final settlement price determined by the exchange.

Price Quotation Eurodollar time deposits pay a fixed rate of interest upon maturity. The rate of interest paid on the face amount of such a deposit is

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[5] See Burghardt et al. (1991) for a more detailed discussion of the LIFFE and SIMEX contracts.

termed an add-on yield because the depositor receives the face amount of the deposit plus an explicit interest payment when the deposit matures. Like other money market rates, the add-on yield for Eurodollar deposits is expressed as an annualized rate based on a 360-day year. Eurodollar futures prices are quoted as an index determined by subtracting the futures add-on yield from 100.

Final Settlement Price Contract settlement is based on the 90-day London Interbank Offered Rate (LIBOR), which is the interest rate at which major international banks with offices in London offer to place Eurodollar deposits with one another. To determine the final settlement price for its Eurodollar futures contract, the CME clearinghouse randomly polls a sample of banks active in the London Eurodollar market at two different times during the last day of trading: once at a randomly selected time during the last 90 minutes of trading, and once at the close of trading. The four highest and lowest price quotes from each polling are dropped and the remaining quotes are averaged to arrive at the LIBOR used for final settlement.

To illustrate the settlement procedure, suppose that the closing price of a Eurodollar futures contract is 96.10 on the day before the last trading day. As with Treasury bill futures, each 1 basis point change in the price of a Eurodollar futures contract is valued at $25. Thus, if the official final settlement price is 96.16, then all traders who carry open long positions from the previous day have $150 ($25 per basis point x 6 basis points) credited to their margin accounts while traders with open short positions from the previous day have $150 subtracted from their accounts. Since the contract is cash settled, traders with open positions when the contract matures never bear the responsibility of placing or accepting actual deposits.

Minimum Price Fluctuation The minimum price fluctuation permitted on the floor of the exchange is 1 basis point, which, as noted above, is valued at $25.

One-Month LIBOR Futures One-month LIBOR futures began trading on the IMM in 1990. The one-month LIBOR contract resembles the three-month Eurodollar contract described above, except that final settlement is based on the 30-day LIBOR.

Contract Settlement Like the three-month Eurodollar contract, the one-month LIBOR contract is cash settled. Settlement is based on a notional principal amount of $3 million.

Price Quotation and Minimum Price Fluctuation Prices on one-month LIBOR futures are quoted as an index virtually identical to that used for three-month Eurodollar futures. The index is calculated by subtracting the 30-day futures LIBOR from 100. The minimum price increment is 1 basis point, which is valued at $25.

Final Settlement Price As with the three-month Eurodollar contract, the final settlement price for one-month LIBOR contract is based on the results of a survey of primary market participants in the London Eurodollar market.

Thirty-Day Interest Rate Futures The Chicago Board of Trade's 30-day interest rate futures contract is a cash-settled contract based on a 30-day average of the daily federal funds rate. The CBT lists contracts for six consecutive delivery months at any one time.

Contract Settlement The 30-day interest rate futures contract differs from other interest rate futures in that the settlement price is based on an average of *past* interest rates. Final settlement is based on an arithmetic average of the daily federal funds rate for the 30-day period immediately preceding the contract maturity date, as reported by the Federal Reserve Bank of New York. The notional principal amount of the contract is $5 million.

Price Quotation As with all other money market futures, prices for 30-day interest rate futures are quoted as an index equal to 100 minus the futures rate. For deferred month contracts—that is, contracts maturing after the current month's settlement date—the futures rate corresponds approximately to a forward interest rate on one-month term federal funds.

In theory, the futures rate for the nearby contract should reflect a weighted average of (1) the average funds rate for the expired fraction of the current month, plus (2) the term federal funds rate for the unexpired fraction of the month. To illustrate, suppose the date is April 21. Twenty days of the month have passed, so the index value for the April contract would reflect

$$100 - \textit{Index} =$$
$$(20/30)(\text{average of the daily federal funds rate for the previous 20 days})$$
$$+ (10/30)(\text{term federal funds rate for 10 days beginning April 21}).$$

At the same time, the price of the May contract would correspond approximately to the forward rate on a 30-day term federal funds deposit beginning May 1. The correspondence to the 30-day rate is only approximate, however, because the settlement price for the contract is based on a simple arithmetic average, which does not incorporate daily compounding.

Minimum Price Fluctuation The minimum price fluctuation is 1 basis point, valued at $41.67.

Trading Activity in Money Market Futures Figures 1 and 2 display a history of trading activity in the four money market futures contracts discussed above. Figure 1 displays total annual trading volume, which is a count of the total number of contracts (not the dollar value) traded for all delivery months. Each

transaction between a buyer and a seller counts as a single trade. Figure 2 plots average month-end open interest for all contract delivery months. Month-end open interest is a count of the number of unsettled contracts as of the end of the last trading day of each month. Each contract included in the open interest count reflects an outstanding futures commitment on the part of both a buyer and a seller.

Trading activity in the Treasury bill futures contract grew steadily from the time the contract was first listed in 1976 through 1982, falling thereafter below 20,000 contracts per day on average. The trading history depicted in Figures 1 and 2 suggests that the introduction of the Eurodollars futures contract attracted some trading activity away from Treasury bill futures.

In recent years, the IMM Eurodollar futures contract has become the most actively traded futures contract based on money market rates and is now one of the most actively traded of all futures contracts. Three factors have contributed to the popularity of Eurodollar futures. First, most major international banks rely heavily on the Eurodollar market for short-term funds and act as marketmakers in Eurodollar deposits. Eurodollar futures provide a means of hedging interest rate risk arising from these activities. Second, the phenomenal growth of the market for interest rate swaps during the last decade has contributed to the growth of trading in Eurodollar futures.[6] Most interest rate swap contracts specify payments contingent on three- or six-month LIBOR. Swap market dealers sometimes use Eurodollar futures to hedge their positions in interest rate swaps. Evidence of the widespread use of Eurodollar futures to hedge swap exposures can be found in the fact that the IMM currently lists Eurodollar futures with delivery dates stretching as far as 60 months into the future. In contrast, virtually all other futures contracts list delivery dates only 24 months into the future (Burghardt et al. 1991). Third, it has become common practice for commercial banks to index interest rates on loans to their corporate customers to LIBOR. Such borrowers sometimes use Eurodollar futures to hedge their borrowing costs. (In recent years, however, it has become more common for such borrowers to arrange interest rate swaps.)

The one-month LIBOR contract enables traders to use futures contracts to synthesize maturities corresponding to a wider range of standard maturities in the Eurodollar market. Other than overnight and one-week deposits, standard maturities in the Eurodollar market range from one to six months in one-month increments, nine months, one year, eighteen months, and two to five years in one-year increments. The one-month LIBOR contract allows a trader to synthetically duplicate the interest rate exposure associated with a four-month Eurodollar deposit, as an example, using a combination of a three-month Eurodollar contract and a one-month LIBOR contract. Although trading in the contract has been

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[6] An interest rate swap is a formal agreement between two parties to exchange cash flows based on the difference between two different interest rates.

FIGURE 1

Total Annual Trading Volume

U.S. Money Market Futures

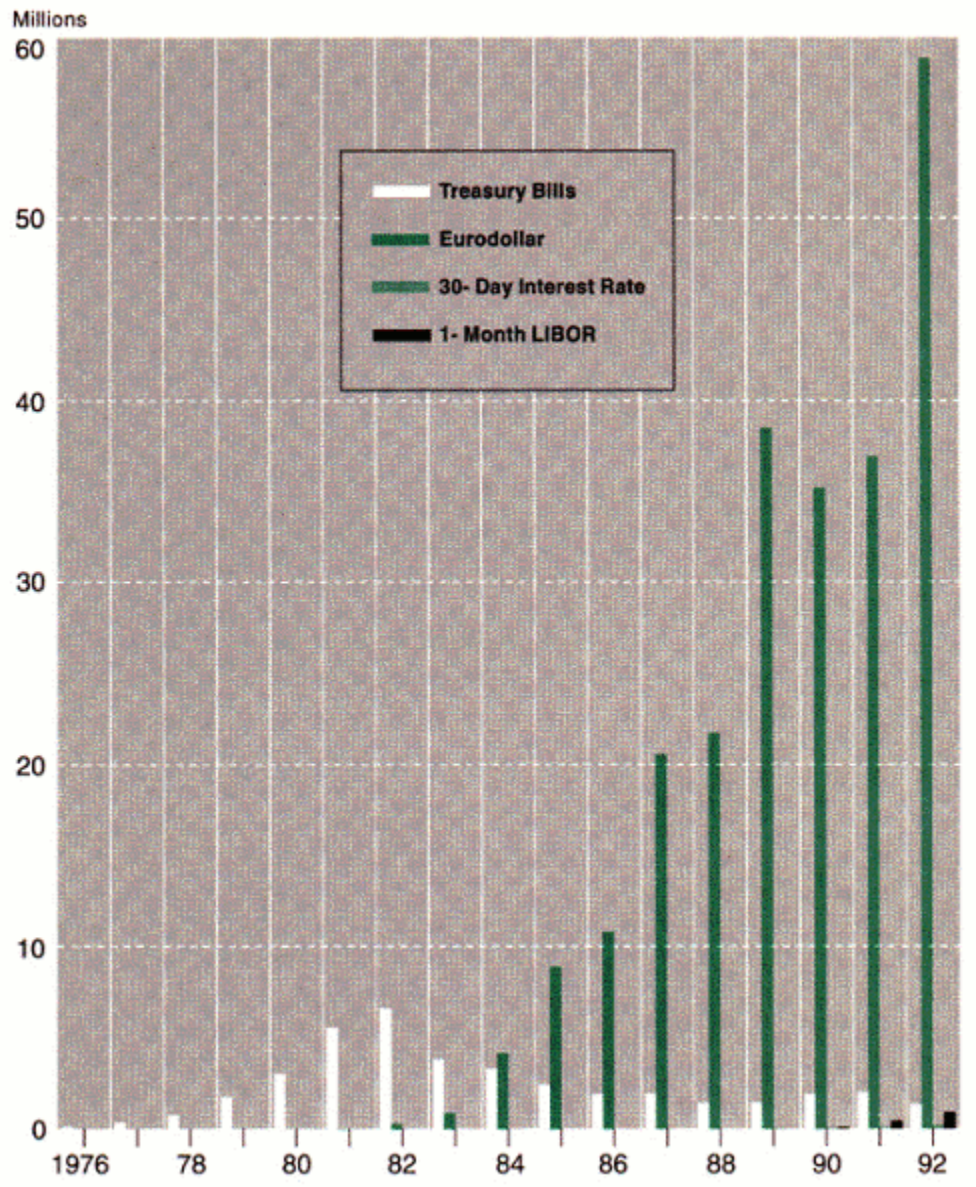
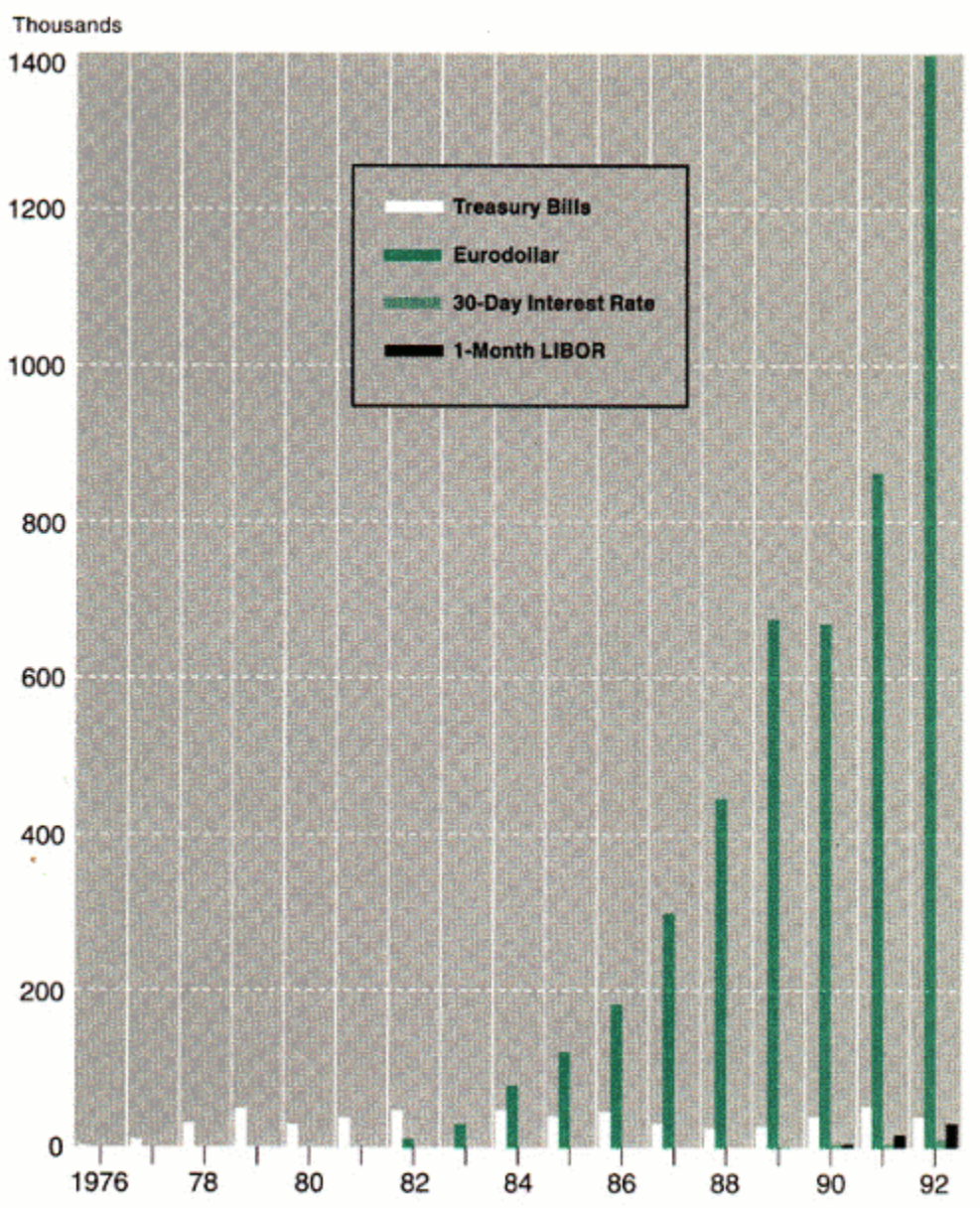


FIGURE 2

Average Month-End Open Interest

U.S. Money Market Futures



active since it was introduced in 1990, Figures 1 and 2 show that trading activity in the one-month LIBOR contract has yet to approach that of the more popular three-month Eurodollar futures contract.

The CBT first listed its 30-day interest rate futures contract in 1988. Although there are differences in the way the one-month LIBOR and 30-day interest contracts are priced, both are based on indexes of one-month interbank lending rates. At present, trading volume in the CBT contract is roughly one-third the volume of trading in the one-month LIBOR contract. Past experience has shown that whenever two different exchanges list futures contracts for similar underlying instruments, only one contract survives. Thus, the current outlook for these latter two contracts remains uncertain as of this writing.

PRICE RELATIONSHIPS BETWEEN FUTURES AND SPOT MARKETS

Price relationships between futures and spot markets can be explained using arbitrage pricing theory, which is based on the premise that two different assets, or combinations of assets, that yield the same return should sell for the same price. Buying a futures contract on the final day of trading is equivalent to buying the underlying item in the cash market, since delivery is no longer deferred once a futures contract matures. Thus, arbitrage pricing theory predicts that the futures price of an item should just equal its spot market price on the futures contract maturity date: this is just the phenomenon of convergence noted earlier. Buying a futures contract before the contract maturity date fixes the cost of future availability of the underlying item. But the cost of future availability of an item can also be fixed in advance by buying and holding that item. Holding actual physical stocks of a commodity or security entails opportunity costs in the form of interest foregone on the funds used to purchase the item and, in some instances, explicit storage costs. The cost associated with financing the purchase of an asset, along with related storage costs, is known as the cost of carry. Since physical storage can substitute for buying a futures contract, arbitrage pricing theory predicts that the cost of carry should determine the relationship between futures and spot market prices.

Basis and the Cost of Carry The cost of carry for agricultural and other commodities includes financing costs, warehousing fees, transportation costs, and any transactions costs incurred in obtaining the commodity. Storage costs are negligible for financial assets such as Treasury bills and Eurodollar deposits. Moreover, financial assets often yield an explicit payout, such as interest or dividend payments, that offsets at least a fraction of any financing costs. The convention in financial markets, therefore, is to apply the term net carrying cost to the difference between the interest cost associated with financing the purchase of a financial asset and any explicit interest or dividend payments earned on that asset.

Let $S(0)$ denote the purchase price of an asset at time 0 and $r(0,T)$ denote the market rate of interest at which market participants can borrow or lend over a period starting at date 0 and ending at some future date T.[7] Assuming, for the sake of convenience, that transactions and storage costs are negligible, the cost of purchasing an item and storing it until date T is just the financing cost $r(0,T)\ S(0)$. Let $y(0,T)$ denote any explicit yield earned on the asset over the same holding period. Then, the net carrying cost for the asset is

$$c(0,T) = [r(0,T) - y(0,T)]S(0).$$

Since physical storage of an item can substitute for buying a futures contract for that item, arbitrage pricing theory would predict that the futures price should just equal the price of the underlying item plus net carrying costs. This result is known as the cost of carry pricing relation. Let $F(0,T)$ denote the futures price of an item at date 0 for delivery at some future date T. Then, the cost of carry pricing relation can be stated formally as:

$$F(0,T) = S(0) + c(0,T).$$

The difference between the spot price of an item and its futures price is known as basis.[8] Notice that the cost of carry pricing relationship equates basis with the negative of the cost of carry. This relationship is easily demonstrated by rearranging terms in the cost of carry relation to yield

$$S(0) - F(0,T) = -c(0,T).$$

Positive carrying costs imply a negative basis—that is, a futures price above the spot market price. In such instances the buyer of a futures contract pays a premium for deferred delivery, known as contango.

Cash-and-Carry Arbitrage To see why futures prices should conform to the cost of carry model, consider the arbitrage opportunities that would exist if they did not. Suppose the futures price exceeds the cost of the underlying item plus carrying costs; that is,

$$F(0,T) > S(0) + c(0,T).$$

In this case, an arbitrageur could earn a positive profit of $F(0,T) - S(0) - c(0,T)$ dollars by selling the overpriced futures contract while buying the underlying item, storing it until the futures delivery date, and using it to satisfy delivery requirements.

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[7] This discussion assumes perfect capital markets in which market participants can borrow and lend at the same rate.

[8] Some authors define basis as the difference between the futures price and the spot price. The definition adopted above is the more common.

This type of transaction is known as cash-and-carry arbitrage because it involves buying the underlying item in the cash market and carrying it until the futures delivery date. Ultimately, the market forces created by arbitrageurs selling the overpriced futures contract and buying the underlying item should force the spread between futures and spot prices down to a level just equal to the cost of carry, where arbitrage is no longer profitable. In practice, arbitrageurs rarely find it necessary to hold their positions to contract maturity; instead, they undertake offsetting transactions when market forces bring the spot-futures price relationship back into alignment.

Example 1: Pricing a Commodity Futures Contract Suppose the current spot price of a commodity is $100 and the market rate of interest is 10 percent. Assuming that transactions and storage costs are negligible, the cost of carry for this commodity for a period of one year is

$$c(0,T) = (0.10)(\$100) = \$10.$$

Thus, the fair futures price for delivery in one year is $110.

Now consider the opportunity for arbitrage if the futures contract in this example is overpriced. If the futures price for delivery in one year's time is $115, an arbitrageur could earn a certain profit by selling futures contracts at $115, borrowing $100 at 10 percent to buy the underlying commodity, and delivering the commodity in fulfillment of contract requirements at the futures delivery date. The total cost of purchasing and storing the underlying commodity for one year is $110, while the short position in a futures contract fixes the sale price of the commodity at $115. Thus, at the end of one year the arbitrageur could close out his position by selling the underlying commodity in fulfillment of contract requirements, thereby earning a $5 profit net of carrying costs.

Example 2: Pricing an Interest Rate Futures Contract Suppose a long-lived asset that pays a 15 percent annual yield can be purchased for $100, and assume that the cost of borrowing to finance the purchase of this asset for one year is 10 percent. In this case, the $10 annual financing cost is more than offset by the annual $15 yield earned on the asset. The net cost of carry for a one-year holding period is

$$(0.10 - 0.15)\$100 = -\$5.$$

Thus, the fair futures price for delivery in one year is $95.

The net cost of carry is negative in this last example, resulting in a futures price below the spot market price. This type of price relationship is known as backwardation. It is common for interest rate futures prices to exhibit a pattern of backwardation, although this pattern can be reversed when short-term interest rates are higher than long-term rates.

Reverse Cash-and-Carry Arbitrage If the futures price of an item fails to reflect full carrying costs, arbitrageurs have an incentive to engage in an operation known as reverse cash-and-carry arbitrage. Reverse cash-and-carry arbitrage involves selling the underlying commodity short while buying the corresponding futures contract. A short sale involves borrowing a commodity or asset for a fixed time period and selling that item in the cash market with the intent of repurchasing it when the commodity is due to be returned to the lender.

In the case of a short sale of an interest-bearing security, a lender typically requires the borrower to return the security plus any interest or dividend payments accruing to the security over the period of the loan. Thus, the net profit resulting from a reverse cash-and-carry operation is determined by the proceeds from the short sale, $S(0)$, plus the interest earned on those proceeds over the holding period, $r(0,T)\ S(0)$, less the cost of repurchasing the security at date T, $F(0,T)$, and less the interest or dividend that would have been earned by holding the security, which is $y(0,T)\ S(0)$. The total net profit in this case is just

$$[1 + r(0,T) - y(0,T)]\ S(0) - F(0,T).$$

Banks active in the Eurodollar market can effect short sales of deposits simply by accepting such deposits from other market participants and investing the proceeds until the deposits mature. Dealers in the Treasury bill market can effect short sales through arrangements known as repurchase agreements. These operations are described in more detail below.

The Phenomenon of "Underpriced" Futures Contracts Futures prices sometimes fail to reflect full carrying costs, a phenomenon that is most pronounced in commodity markets. At least two different explanations have been offered for this phenomenon: the first deals with impediments to short sales; the second with the implicit convenience yield that accrues to physical ownership of certain assets.

Reverse cash-and-carry arbitrage operations require that market participants be able to effect short sales of the item underlying the futures contract so as to take advantage of an underpriced futures contract. Various impediments to short sales exist in some markets, however. In the stock market, for example, government regulations, as well as stock exchange trading rules, limit the ability of market participants to effect short sales.

The importance of such impediments is mitigated by the fact that it is not always necessary to engage in a short sale to effect a reverse cash-and-carry arbitrage operation. Many firms are ideally situated to take advantage of the opportunities presented by underpriced futures contracts simply by selling any inventories they hold while buying futures contracts to fix the cost of buying back the underlying item. Yet market participants often do not sell their asset holdings to take advantage of "underpriced" futures contracts because ready

access to actual physical stores of an item can yield certain implicit benefits. For example, a miller might value having a ready supply of grain on hand to ensure the uninterrupted operation of his milling operations. A futures contract can substitute for physical holdings of the underlying commodity in the sense that it fixes the cost of future availability, but the miller cannot use futures contracts to keep his mill operating in the event that he runs out of grain. Supplies of agricultural commodities can be scarce in periods just preceding harvests, making market participants such as commodity processors willing to pay an implicit convenience yield in return for assured access to physical stores of a commodity at such times. A measure of the implicit convenience yield, call it $y_c(0,T)$, can be obtained by calculating the difference between the cost of storage and the futures price:

$$y_c(0,T) = S(0) + {}_c(0,T) - F(0,\ T),$$

where the term $c(0,T)$ in the above expression represents the explicit carrying cost.[9]

Pricing Treasury Bill Futures: The Implied Repo Rate A repurchase agreement, more commonly termed a "repo" or "RP," is a transaction involving the sale of a security with a commitment on the part of the seller to repurchase that security at a higher price on some future date—usually the next day, although such agreements sometimes cover periods as long as six months. A repurchase agreement can be viewed as a short-term loan collateralized by the underlying security, with the difference between the repurchase price and the initial sale price implicitly determining an interest rate, known as the "repo rate." Repurchase agreements constitute a primary funding source for dealers in the market for U.S. Treasury securities.

Cash-and-carry arbitrage using Treasury bill futures involves the purchase of a bill that will have 13 weeks to maturity on the contract delivery date. A cash-and-carry arbitrage operation can be viewed as an implicit reverse repurchase agreement, which is just a repurchase agreement from the viewpoint of the lender. A reverse repo entails the purchase of a security with a commitment to sell the security back at some future date. A party entering into a reverse repo effectively lends money while taking the underlying security as collateral. Like a party to a reverse repo, a trader who buys a Treasury bill while selling a futures contract obtains temporary possession of the bill while committing himself to sell it back to the market at some future date. Just as the difference between the purchase price of a bill and the agreed-upon sale price determines the interest rate earned by a party to a reverse repo, the difference between the futures and spot

[9] Siegel and Siegel (1990, Chap. 2) contains a good introductory discussion of these topics. See Williams (1986) for a comprehensive analysis of the price behavior of agricultural futures.

price determines the return to a cash-and-carry arbitrage operation. In effect, the trader "lends" money to the market, earning the difference between the future delivery price and the price paid for the security as implicit interest. The rate of return earned on such an operation is known as the "implied repo rate."

By market convention, the implied repo rate is expressed as the annualized rate of return that could be earned by buying a Treasury bill at a price $S(0)$ at date 0 and simultaneously selling a futures contract for delivery at date T for a price $F(0,T)$. The formula is

$$irr = \{[F(0,T) - S(0)]/S(0)\}(360/T),$$

where *irr* denotes the implied repo rate. Note that this formula follows the convention in money markets of expressing annual interest rates in terms of a 360-day year.

The following example illustrates the calculation of the implied repo rate. Suppose that it is exactly 60 days to the next delivery date on three-month Treasury bill futures. A bill with 151 days left to maturity will have 91 days left to maturity on the next futures delivery date and can be used to satisfy delivery requirements for the nearby futures contract. If the current discount yield on bills with 151 days to maturity is 3.8 percent, the cash price of the bill is

$$\begin{aligned} S(0) &= \$1{,}000{,}000 - \$1{,}000{,}000(0.038)(151/360) \\ &= \$984{,}061.11. \end{aligned}$$

Now suppose that the price of the nearby Treasury bill futures contract is 96.25. An index price of 96.25 implies a futures discount yield for the nearby Treasury bill contract of 100 - 96.25 = 3.75 percent. Since the deliverable bill will have 91 days to maturity, the future delivery price implied by this yield is

$$\begin{aligned} F(0,60) &= \$1{,}000{,}000 - \$1{,}000{,}000(0.0375)(91/360) \\ &= \$990{,}520.83. \end{aligned}$$

The implied repo rate in this case is

$$\begin{aligned} irr &= [(\$990{,}520.83 - \$984{,}061.11)/\$984{,}061.11](360/60) \\ &= 0.0394, \end{aligned}$$

or 3.94 percent.

The cost of carry pricing relation can be used to show that the no-arbitrage price should equate the implied repo rate with the actual repo rate. To see this, note that the cost of carry pricing relation implies that the no-arbitrage price must satisfy

$$F(0,T) - S(0) = c(0,T).$$

Although Treasury bills are interest-bearing securities, the interest earned on a bill is implicit in the difference between the purchase and redemption price.

This means that $y(0,T) = 0$, so that total net carrying costs for a Treasury bill must just equal

$$c(0,T) = r(0,T)\ S(0),$$

where $r(0,T)$ represents the cost of financing the purchase of the bill, expressed as an unannualized interest rate. Substituting these last two expressions into the definition of the implied repo rate gives

$$irr = r(0,T)(360/T).$$

Because repurchase agreements constitute a primary funding source for dealers in the Treasury bill market, $r(0,T)$ should reflect the cash repo rate.[10] Thus, the cost of carry pricing relation implies that the implied repo rate should just equal the cash repo rate.

Comparing implied repo rates with actual rates amounts to comparing theoretical futures prices, as determined by the cost of carry model, with actual futures prices. An implied repo rate above the actual three-month repo rate would indicate that futures contracts are relatively overpriced. In this case arbitrage profits could be earned by borrowing money in the cash repo market and implicitly lending the money back out through a cash-and-carry arbitrage to earn the higher implied repo rate.

Conversely, an implied repo rate below the actual rate would indicate that futures contracts are underpriced. In this second case, arbitrageurs would have an incentive to "borrow" money by means of a reverse cash-and-carry futures hedging operation while lending into the cash market through a reverse repo. Such an operation would entail buying an underpriced futures contract and simultaneously entering into a reverse repurchase agreement to lend money into the cash repo market.

The concept of an implied repo rate can also be applied to other types of financial futures. Merrick (1990) and Siegel and Siegel (1990) discuss other applications.

Pricing Eurodollar Futures Now consider the problem of determining the theoretically correct price of a three-month Eurodollar futures contract maturing in exactly 90 days. Note that a six-month deposit can be viewed as a succession of two three-month deposits. Thus, a bank can synthesize an implicit six-month deposit by placing a three-month deposit and buying a futures contract to fix the rate of return earned when the proceeds of the first deposit are reinvested into another deposit. Arbitrage opportunities will exist unless the return to this synthetic six-month deposit equals the return to the actual six-month deposit.

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[10] Gendreau (1985) found empirical support for the assertion that the repo rate provides the correct measure of carrying costs for Treasury bill futures.

Let $r(0,3)$ and $r(0,6)$ denote the current (unannualized) three- and six-month LIBOR, respectively. Eurodollar deposits pay a fixed rate of interest over the term of the deposit. For maturities under one year, interest is paid at maturity. Thus, an investor placing $1 in a 180-day deposit paying an interest rate of $r(0,6)$ receives $\$[1 + r(0,6)]$ at maturity. Similarly, a 90-day deposit will return $[1 + r(0,3)]$ per dollar at maturity. Now let $r_f(3,6)$ denote the interest rate on a three-month deposit to be placed in three months fixed by buying a Eurodollar futures contract. The condition that a six-month deposit should earn as much as a succession of two three-month deposits requires that

$$1 + r(0,6) = [1 + r(0,3)][1 + r_f(3, 6)].$$

The no-arbitrage futures interest rate can thus be calculated from the other two spot rates by rearranging terms to yield

$$r_f(3,6) = [1 + r(0,6)]/[1 + r(0,3)] - 1.$$

As an example, suppose the prevailing three-month LIBOR is quoted at 4.0 percent and the six-month LIBOR at 4.25 percent (in terms of annualized interest rates). Suppose further that the six-month rate applies to a period of exactly 180 days and the three-month rate applies to a period of 90 days. Finally, assume that the nearby Eurodollar contract conveniently happens to mature in exactly 90 days. Then, the no-arbitrage interest rate on a three-month Eurodollar deposit to be made three months in the future is

$$r_f(3,6) = [1 + (0.0425)(180/360)]/[1 + (0.04)(90/360)] - 1$$
$$= 0.0111.$$

To express this result as an annualized interest rate just multiply the number obtained above by (360/90). The result is

$$r_f(3,6)(360/90) = 0.0444,$$

which means that the no-arbitrage futures interest rate in this example is 4.44 percent and the theoretically correct index price is 95.56. The same methodology can be used to price one-month LIBOR futures.[11]

If the futures rate is below the no-arbitrage rate, the interest rate on a synthetic six-month deposit will be less than on an actual six-month deposit. A bank can effect a cash-and-carry arbitrage operation by "buying" a six-month deposit now (that is, by placing a deposit with another bank) while accepting a three-month deposit and selling a Eurodollar futures contract. In this case, arbitrage amounts to lending at the higher spot market rate (by placing a six-month deposit with

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[11] Readers interested in a more detailed exposition of forward interest rate calculations and the pricing of Eurodollar futures should see Burghardt et al. (1991).

another bank) while borrowing at the lower synthetic six-month rate (obtained by accepting a three-month deposit and selling a futures contract).

Conversely, a futures interest rate above the theoretically correct rate is a signal for banks to enter into a reverse cash-and-carry arbitrage. In this case, a bank would wish to accept a six-month deposit to borrow at the lower spot market rate while placing a three-month deposit and buying the nearby futures contract to lend at the higher synthetic six-month rate.

Daily Settlement and the Cost of Carry As a concluding comment, it should be noted that the pricing formulas developed in this section do not take account of the effect of variation margin flows. When interest rates fluctuate randomly, the fact that a futures contract is marked to market on a daily basis means that some of the payoff to a futures position will need to be reinvested at different interest rates. Thus, the cost of carry formulas derived above hold exactly only if interest rates are constant or if there are no variation margin payments, as typically is the case with forward agreements (Cox, Ingersoll, and Ross 1981). In all other cases, the formulas derived above yield theoretical futures prices that only approximate true theoretical futures prices. As an empirical matter, however, the approximation appears to be a close one, so that the cost of carry model is commonly used to price futures contracts as well as forward contracts.[12]

THE ECONOMIC FUNCTION OF FUTURES MARKETS

Hedging, Speculation, and Futures Markets It is common to categorize futures market trading activity either as hedging or speculation. In the most general terms, a futures hedging operation is a futures market transaction undertaken in conjunction with an actual or planned spot market transaction. Futures market speculation refers to the act of buying or selling futures contracts solely in an attempt to profit from price changes, and not in conjunction with an ordinary commercial pursuit. According to these definitions, then, a dentist who buys wheat futures in anticipation of a rise in wheat prices would be classified as a speculator, while a grain dealer undertaking a similar transaction would be regarded as a hedger.

Speculators have been active participants in futures markets since the earliest days of futures trading. On several occasions, the perception that futures market speculation exerted a destabilizing influence on commodity markets led to attempts to restrict or ban futures trading.[13] But despite the association of

[12] Chance (1989) reviews the results of studies dealing with the effect of variation margin payments on futures prices.

[13] One of the most drastic efforts to curb futures trading involved the arrest of nine prominent members of the Chicago Board of Trade following the enactment of the Illinois Elevator Bill of 1867. The Act classified the sale of contracts for future delivery as gambling except in cases where the seller actually owned physical stocks of the commodity being sold. Those provisions were soon repealed, however, and the exchange members never came to trial (Hieronymus 1971, Chap. 4).

speculative activity with futures trading, it is widely accepted that futures markets evolved primarily in response to the needs of commodity handlers, such as dealers in agricultural commodities and processing firms, who used futures contracts in conjunction with their routine business transactions. The same types of market forces appear to underlie the recent growth of trading in financial futures, the heaviest users of which are financial intermediaries such as commercial banks, securities dealers, and investment funds that routinely use futures contracts to hedge cash transactions in financial markets.

While it is widely accepted that futures markets evolved to facilitate hedging, the motivation behind observed hedging behavior in futures markets has been the topic of considerable debate among economists. Risk transfer traditionally has been viewed as the primary economic function of futures markets. According to this view, the economic purpose of futures markets is to provide a means for transferring the price risk associated with owning an item to someone else. A number of economists have come to question this traditional view in recent years, however, arguing that the desire to transfer price risk cannot fully explain why market participants use futures contracts.

The discussion that follows examines the hedging uses of money market futures and reviews three different views of the economic function of futures markets in an effort to provide some insight into the reasons firms use futures markets. All three theories are based on the premise that futures markets evolved to facilitate hedging on the part of firms active in underlying spot markets, but the different theories each emphasize different characteristics of futures contracts and futures markets to explain why hedgers use futures contracts. This review is of more than academic interest. Futures hedging operations are complex and multifaceted transactions, and each theory provides important insights into different aspects of hedging behavior.

Futures Markets as Markets for Risk Transfer In conventional usage, the term "hedging" refers to an attempt to avoid or lessen the risk of loss by matching a risk exposure with a counterbalancing risk, as in hedging a bet. A futures hedge can be viewed as the use of futures contracts to offset the risk of loss resulting from price changes. A short (cash-and-carry) hedging operation, for example, combines a short futures position with a long position in the underlying item to fix the future sale price of that item, thereby protecting the hedger from the risk of loss resulting from a fall in the value of his holdings. Reverse cash-and-carry arbitrage, which combines a short position in an item with a long futures position, represents an example of a long hedge. The long futures position offsets the risk that the price of the underlying item might rise before the hedger can

buy the item back to return to the owner. More generally, a long hedge combines a long futures position with a planned future purchase of an item to produce an offsetting risk that protects the hedger from the risk of an increase in the future purchase price of the item.

Most textbook hedging examples rely on this traditional definition of hedging to motivate descriptions of hedging operations. Thus, a dealer in Treasury securities might sell Treasury bill futures to offset the risk that an unanticipated rise in market interest rates will adversely affect the value of his securities holdings. Note that the short hedge in this example effectively shortens the maturity of the interest-bearing asset being hedged. In contrast, a long hedge fixes the return on a future investment, thereby lengthening the effective maturity of an existing interest-earning asset.

This traditional definition of hedging accords with the view that the primary function of futures markets is to facilitate the transfer of price risk. The party buying the futures contracts in the above example might be an investor planning to buy Treasury bills at some future date or a speculator hoping to profit from a decline in market interest rates. In the first case the risk exposure is transferred from one hedger to another who faces an opposite risk. In the second, the risk is willingly assumed by the speculator in the hope of earning windfall gains.

Other common hedging operations involving money market futures can also be viewed as being motivated by the desire to transfer price risk. For example, commercial banks, savings and loans, and insurance companies use interest rate futures to protect their balance sheets and future earnings from potentially adverse effects of changes in market interest rates.[14] In addition, nonfinancial firms sometimes use interest rate futures to fix interest rates on anticipated future investments and borrowing rates on future loans.

The Liquidity Theory of Futures Markets Working (1962) and Telser (1981, 1986) contend that the hedging behavior of firms cannot be understood by looking at risk avoidance alone as the primary motivation for hedging. Instead, they argue that the hedging behavior of optimizing firms is best understood when hedging is viewed as a temporary, low-cost alternative to planned spot market transactions. According to this line of reasoning, futures markets exist primarily because they provide market participants with a means of economizing on transactions costs, and not solely because futures contracts can be used to transfer price risk. Williams (1986) has termed this view the liquidity theory of futures markets.

Working's and Telser's arguments rest on the observation that market participants need not use futures contracts to insure themselves against price risk. As

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[14] Brewer (1985) and Kaufman (1984) discuss the problem such firms face in managing interest rate risk.

noted in the earlier discussion on arbitrage pricing, spot purchases (or short sales) of an item can substitute for buying (selling) a futures contract to fix the cost of future availability (future sale price) of an item. Moreover, forward contracts can also be used to transfer price risk. Because they can be custom-tailored to the needs of a hedger, forward contracts would appear to offer a better means of insuring against price risk than futures contracts. Contract standardization, while contributing to the liquidity of futures markets, practically insures that futures contracts will not be perfectly suited to the needs of any one hedger.[15] It would seem, then, that a hedger interested solely in minimizing price risk would have little incentive to use futures contracts, a conclusion which suggests that the view of futures markets as markets for transferring price risk is incomplete.

Although it makes futures contracts less suited to insuring against price risk, contract standardization, along with the clearinghouse guarantee, facilitates trading in futures contracts and reduces transactions costs. By focusing attention on these characteristics of futures contracts, Working (1962) and Telser (1981, 1986) are able to explain why dealers and other intermediaries who perform the function of marketmakers in spot markets tend to be the primary users of futures contracts. Market-making activity requires dealers to constantly undertake transactions that change the composition of their holdings. Securities dealers, for example, must stand ready to buy and sell securities in response to customer orders. As they do, their cash positions change continually, along with their exposure to price risk. Similarly, the assets and liabilities of commercial banks change continually as they accept deposits and offer loans to their customers. Thus, financial intermediaries such as commercial and investment banks hedge using futures contracts because the greater liquidity and lower transactions costs in futures markets mean that a futures hedge can be readjusted frequently with relatively little difficulty and at minimal cost.

To illustrate these concepts, consider the situation faced by an investor who holds a three-month Treasury bill but wishes to lengthen the effective maturity of his holding to six months. The investor could sell the three-month bill and buy a six-month bill, or he could buy a futures contract for a three-month Treasury bill deliverable in three months. A long hedging operation of this type effectively converts the three-month bill into a synthetic six-month bill. The preferred strategy will depend on the relative costs of the two alternatives. Since transactions costs in futures markets tend to be lower than those in underlying spot markets, the futures hedge is often the more cost-effective alternative.

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[15] Since planned transaction dates rarely coincide with standardized futures delivery dates, most hedgers must unwind their futures positions before the contracts mature. As a result, hedging operations must rely upon the predictability of the spot-futures price relationship, or basis. Although theory predicts that behavior of basis should be determined by the cost of carry, changes in the spot-futures price relationship are not always predictable in practice. Thus, a futures hedge involves "basis risk," which is much easier to avoid with forward contracts.

Futures Markets as Implicit Loan Markets Williams (1986) argues that futures markets are best viewed as implicit loan markets, which exist because they provide an efficient means of intermediating credit risk. Recall that a firm that needs to hold physical inventories of some item for a fixed period has two choices. First, it can make arrangements to borrow the item directly, often by pledging some form of collateral such as cash or securities to secure the loan. Second, it can buy the item in the spot market and hedge by selling the appropriate futures contract. In either case, the firm will have temporary use of the item and will be required to return (deliver) that item at some set future date. Depending on one's view, therefore, a short hedger is either extending a loan of money collateralized by the item underlying the futures contract or borrowing the underlying commodity using cash as collateral.

A natural question to ask at this juncture is why a firm would choose to engage in a cash-and-carry hedging operation to synthesize an implicit loan of an item rather than borrowing the item outright. The answer lies with the advantages that futures contracts have in the event of default or bankruptcy. Consider the consequences of a default on the part of a firm that loans out securities while borrowing cash. Suppose firm A enters into a repurchase agreement with firm B. If firm A defaults on its obligations, firm B cannot always be assured that the courts will permit it to keep the security collateralizing the loan because the "automatic stay" provisions of the U.S. Bankruptcy Code may prevent creditors from enforcing liens against a firm that enters into bankruptcy proceedings. Thus, when Lombard-Wall, Inc. entered bankruptcy proceedings in 1982, its repurchase agreement counterparties could neither use funds obtained through a repurchase agreement or sell underlying repo securities without first obtaining the court's permission (see Chapter 6 in this book).

Subsequent amendments to the U.S. Bankruptcy Code have clarified the steps needed to perfect a collateral interest in securities lending arrangements, making it possible for investors to avoid many of the difficulties Lombard-Wall's counterparties encountered with the Bankruptcy Court. Nevertheless, collateralized lending agreements are never riskless. A party to a reverse RP, for example, faces the risk that the market value of the underlying security might fall below the agreed-upon repurchase price. Moreover, parties to mutual lending arrangements sometimes fraudulently pledge collateral to several different creditors. In either case, a lender is exposed to the risk of loss in the event of a default on the part of a borrower. Finally, the Bankruptcy Code amendments do not apply to all types of lending. For example, Eurodollar deposits cannot be collateralized under existing banking laws.

The consequence of a default is quite different when a firm uses futures contracts to synthesize an implicit loan. Because synthesizing a loan through the use of futures contracts involves no exchange of principal, the risk exposure associated with a futures contract in the event of a default is much smaller than

the exposure associated with an outright loan. Thus, a futures hedging operation amounts to a collateralized lending arrangement in which the collateral is never at risk in the event of a default. A position in a futures contract does create credit-risk exposure when changes in market prices change the value of the contract; however, the resulting exposure is a small fraction of the notional principal amount of the contract, and the exchange clearinghouse risks losing only the change in value in the futures contract resulting from price changes in the most recent trading session. Here, daily settlement, or marking to market, of futures contracts provides an efficient means of enforcing contract performance. In the event that a firm fails to meet a margin call, the clearinghouse can order its futures position to be liquidated and claim the firm's margin deposit to offset any losses accruing to the futures position. If the defaulting firm subsequently enters formal bankruptcy proceedings, the futures margin is exempt from the automatic stay imposed by the Bankruptcy Code.[16] Thus, a futures clearinghouse is entitled to seize a trader's margin deposit to offset any trading losses without being required to first appeal to the Bankruptcy Court.

Although forward contracts can also be used to synthesize implicit loans in much the same way as futures contracts, Williams (1986) argues that a crucial difference between futures contracts and forward agreements lies with their legal status in the event of default and bankruptcy proceedings. While forward agreements sometimes specify margin deposits, such deposits have not, until very recently, been exempt from the automatic stay provisions of the Bankruptcy Code.[17]

These observations led Williams to conclude that futures markets are best viewed as markets for intermediating short-term loans, which resemble money markets. Although Williams' rationale for the existence of futures markets differs in emphasis from that of Working and Telser, the two theories are not inconsistent. While Williams acknowledges that futures markets have certain advantages over other markets stemming from greater liquidity and lower transactions costs, he argues that Working and Telser place too much importance on contract standardization and transactions costs as primary reasons for the existence of futures markets. In the end, however, both theories question the traditional view that the primary function of futures markets is to accommodate the transfer of price risk.

Since Williams published his work, the Bankruptcy Code has been amended to exempt certain repurchase agreements and forward agreements from the automatic stay provisions applicable to most other liabilities of bankrupt firms.

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[16] Williams (1986) cites a precedent-setting legal decision that exempted margin deposits from the automatic stay provisions of the Bankruptcy Code.

[17] Recent amendments to the Bankruptcy Code exempt margin deposits on certain types of forward contracts from the automatic stay. See Gooch and Pergam (1990) for a detailed description of these amendments.

As a result, such contracts now have a legal status similar to that of futures contracts in the event of bankruptcy. Williams' theory would thus predict that repurchase agreements and forward contracts should become more widely used, which is what has happened in recent years. Rather than replacing futures contracts, however, the growth of over-the-counter derivatives such as interest rate swaps and Forward Rate Agreements appears to be driving an accompanying increase in trading in futures contracts, especially Eurodollar futures, which derivatives dealers use to hedge their swap and forward contract exposures. Thus, even when forward agreements and collateralized lending arrangements carry the same legal status as futures contracts in the event of a default, each type of contract appears to offer certain advantages to different types of users. Still, Williams' research highlights an important aspect of futures contracts and futures markets not addressed by earlier work in this area.

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Chapter 15
OPTIONS ON MONEY MARKET FUTURES

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INTRODUCTION

Options are contracts that give their buyers the right, but not the obligation, to buy or sell a specified item at a set price within some predetermined time period. Options on futures contracts, known as futures options, are standardized option contracts traded on futures exchanges. Although an active over-the-counter market in stock options has existed in the United States for almost a century, the advent of exchange-traded options is a more recent development. Standardized options began trading on organized exchanges in 1973, when the Chicago Board Options Exchange (CBOE) was organized. The American and Philadelphia Stock Exchanges soon followed suit by listing stock options in 1975, followed one year later by the Pacific Stock Exchange. Today a wide variety of options trade on virtually all major stock and futures exchanges, including stock options, foreign currency options, and futures options.

Options on three different short-term interest rate futures are traded actively at present. The International Monetary Market (IMM) division of the Chicago Mercantile Exchange (CME) began listing options on three-month Eurodollar time deposit futures in March of 1985, and on 13-week Treasury bill futures a year later. Trading in options on IMM One-Month LIBOR futures began in 1991. The London International Financial Futures Exchange also lists options on its Eurodollar futures contract, but the IMM contract is the more actively traded of the two by a substantial margin.

DEFINITIONS AND BASIC CONCEPTS

Call Options A call option gives a buyer the right, but not the obligation, to buy a specified item at a stipulated "exercise" or "strike" price. The underlying item can be a security such as a common stock or a Treasury bond, a specified amount of a commodity, or a futures contract. Call options are bought and sold for a market-determined premium termed the call price. The buyer, or "holder," of an option is said to take on a long position while the seller, or "writer,"

assumes a short position in the option. In exchange for the premium, the writer of a call option assumes a contractual obligation to sell the underlying instrument for the amount specified by the strike price at the buyer's option. When the holder of a call option acts to purchase the underlying item he is said to exercise the option. An American-style option can be exercised at any time up to the contract expiration date, while a European option can be exercised only on its expiration date. The futures options described in this chapter are all examples of American options, as are virtually all exchange-traded options.

Put Options The buyer of a put option receives the right to sell a specified item at the strike or exercise price specified by the contract. In exchange for a cash premium (put price), the seller of a put option agrees to buy the underlying security for the amount stipulated by the strike price at the buyer's option.

Standardized Options A standardized, or exchange-traded, option always specifies a uniform underlying instrument, one of a limited number of strike prices, and one of a limited number of expiration dates. Contract specifications are determined by the exchange listing the contract. As with futures contracts, contract performance for exchange-traded options is guaranteed by a clearing corporation that interposes itself as a third party to each option contract. The clearing corporation becomes the seller to each buyer and the buyer to each seller, thereby removing the risk to option buyers that a seller might fail to meet contract obligations. Option buyers are not required to post margins because their risk of loss is limited to the premium paid for the option.[1] A change in the market price of an underlying item can expose an option writer to a substantial risk of loss, however, and expose the clearing corporation to default risk. Hence, the exchange clearinghouses require option writers to maintain margin accounts similar to those required of traders in futures contracts and mark the value of all outstanding contracts to market at the end of each trading session.

Contract standardization, together with the clearing corporation guarantee, facilitates trading in standardized options. As a result, a holder or writer of an exchange-traded option can always liquidate an open position before expiration through an offsetting transaction. The holder of a call option, for example, can offset an open position by selling a call option with the same strike price and expiration date. In this case, the difference between the premium originally paid for the option and the premium received from the sale determines the total profit or loss from holding the option. Similarly, the holder of a put option can liquidate his position by selling a put with the same strike price and expiration date.

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[1] Some exchanges, such as the Philadelphia Stock Exchange, permit option buyers to post margin in lieu of requiring payment of the option premium at the time of the purchase (see Grabbe [1991], Chap. 6). The CME requires payment of the option premium at the time it is purchased, however.

As with futures contracts most positions in standardized options are liquidated through offsetting transactions before they expire; occasionally, futures options are exercised before expiration.

Futures Options Trading in futures options takes place in trading areas, or pits, situated next to the trading pits for the underlying futures contracts. A buyer who exercises a futures call option assumes a long futures position by buying the underlying futures contract at the strike price. The writer, in turn, must take on a corresponding short futures position by selling the underlying futures contract at the same price. The reverse holds true with futures put options. Exercising a futures put option creates a short futures position for the holder and a corresponding long position in the underlying contract for the writer. The resulting futures position can be liquidated through an offsetting futures transaction.

When an option on a futures contract expires on the same day the underlying futures contract matures, exercising a futures option at expiration is equivalent to exercising an option on an actual cash item. The IMM's options on Eurodollar and LIBOR futures are examples of futures options that expire on the underlying futures contract maturity date. In these two cases, however, the underlying futures contracts are both cash settled. Therefore, options on these two futures contracts employ the same cash settlement procedure as the underlying futures contracts.

The principal advantage of futures options over options on physicals stems from the fact that most traders find delivery requirements less burdensome for futures options than options on actual physical items. Futures markets tend to be more liquid and have lower transactions costs than underlying cash markets. Thus, while the exercise of an option on an actual cash item requires the writer to buy or deliver that item, the exercise of a futures option results only in a long or short futures position, which is easy to offset. Such considerations are especially important to put and call writers, most of whom sell options in order to earn premium income rather than to buy or sell the underlying item (Chance 1989, Chap. 12).

CONTRACT SPECIFICATIONS FOR IMM OPTIONS ON MONEY MARKET INTEREST RATE FUTURES

Options on Treasury Bill Futures Options on three-month Treasury bill futures began trading in April of 1986. The IMM currently lists options for the first four contract delivery months, making the furthest expiration date of a traded option one year in the future. Expiration dates for traded contracts fall approximately three to four weeks before the underlying futures contract matures.[2]

[2] The expiration date is the business day nearest the underlying futures contract month that (1) is the last business day of the week and (2) precedes the futures contract month by at least six business days.

Price Quotation Premiums for Treasury bill futures options are quoted in terms of basis points of the IMM index for the underlying futures contract. As with the underlying futures contract the minimum price fluctuation is 1 basis point, valued at $25. Thus, a quote of 0.35 represents an options premium of $875 (35 basis points x $25 per basis point).

Strike Price Intervals Strike price intervals are 25 basis points. Thus, listed strike prices might be 95.00 or 95.25, but not 95.05.

Options on Eurodollar Futures Options on three-month Eurodollar futures began trading on the IMM in March 1985. The exchange lists options for the first six underlying futures contract expiration months, making the furthest expiration date for Eurodollar futures options 18 months in the future. Since 1992 the exchange has also listed two "serial expiration month" contracts for the nearby futures contract, which means that the exchange lists options with expiration dates falling during the two months immediately preceding the nearby contract month. To take an example, when the March Eurodollar futures contract matures the IMM begins listing two additional options—with expiration dates in April and May—on the June futures contract. Listed options for more distant futures maturity dates are limited to contracts expiring on the futures contract maturity date, however. Thus, serial expiration month options for the September futures contract are not listed until the June contract expires. Altogether, options for as many as eight separate expiration months may trade at any one time.

Since serial month options expire before the underlying futures contract matures, exercising such an option always results in a long or short futures position. For options expiring on the same day the underlying futures contract matures, final settlement follows the same cash settlement procedure used for the underlying futures contract. To illustrate, consider the payoff to a long position in a Eurodollar futures call option with a strike price of 95.00 held to expiration. If the final settlement price for the underlying futures contract is 95.50, a call holder exercising the option upon expiration receives $1,250 (50 x $25).

Price Quotation Put and call premiums are quoted in terms of basis points of the underlying futures price index. As with the underlying futures contracts the minimum price fluctuation is 1 basis point, with each basis point valued at $25.

Strike Price Intervals Strike price intervals for Eurodollar futures options are 25 basis points.

Options on One-Month LIBOR Futures Options on one-month LIBOR futures began trading on the IMM in June 1991. Like Eurodollar futures options, one-month LIBOR futures options are cash-settled contracts that expire on the day the underlying futures contract matures. The IMM lists options on all six listed one-month LIBOR futures contract months.

Price Quotation Premiums are quoted in terms of basis points of the underlying futures price index. The minimum price fluctuation is 1 basis point, valued at $25.

Strike Price Intervals Strike price intervals are 25 basis points.

Trading Activity in Money Market Futures Options Figures 1 and 2 display a history of trading activity for options on money market futures. Figure 1 shows total annual trading volume. As with measures of futures trading volume, measured trading volume in futures options reflects the total number of contracts traded for all contract expiration dates, with each transaction between a buyer and seller counting as a single trade. Figure 2 plots average month-end open interest for all contract expiration dates. Month-end open interest counts the number of unsettled contracts as of the end of the last trading day of each month. Each contract included in the open interest count reflects an outstanding options position on the part of both a buyer and a seller.

FIGURE 1

Total Annual Trading Volume

U.S. Money Market Options

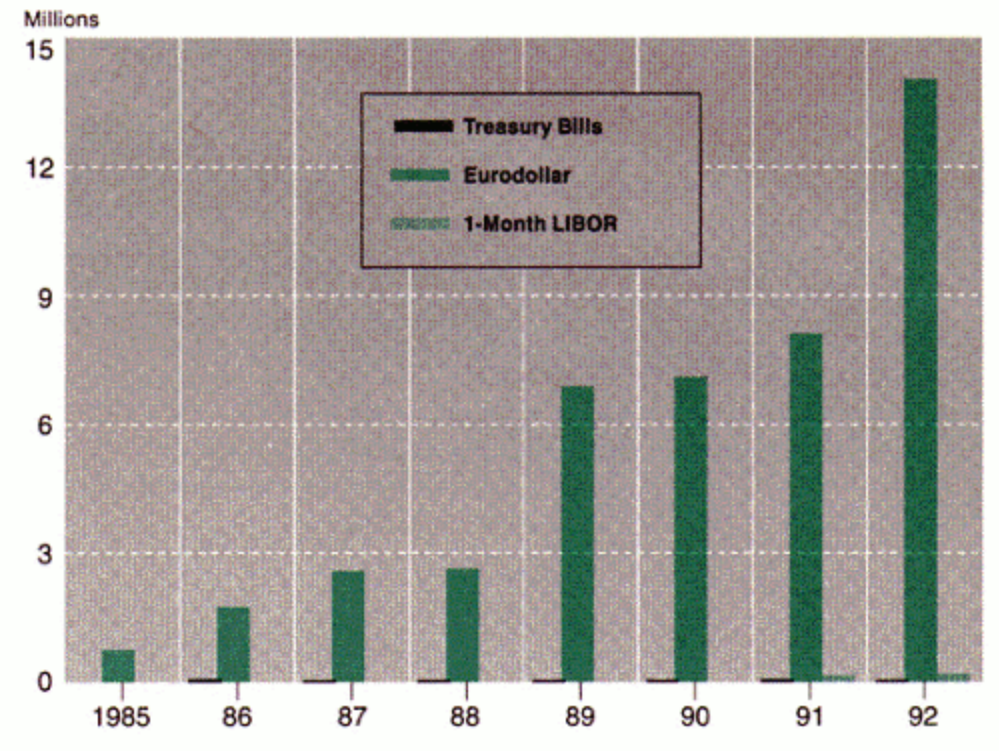
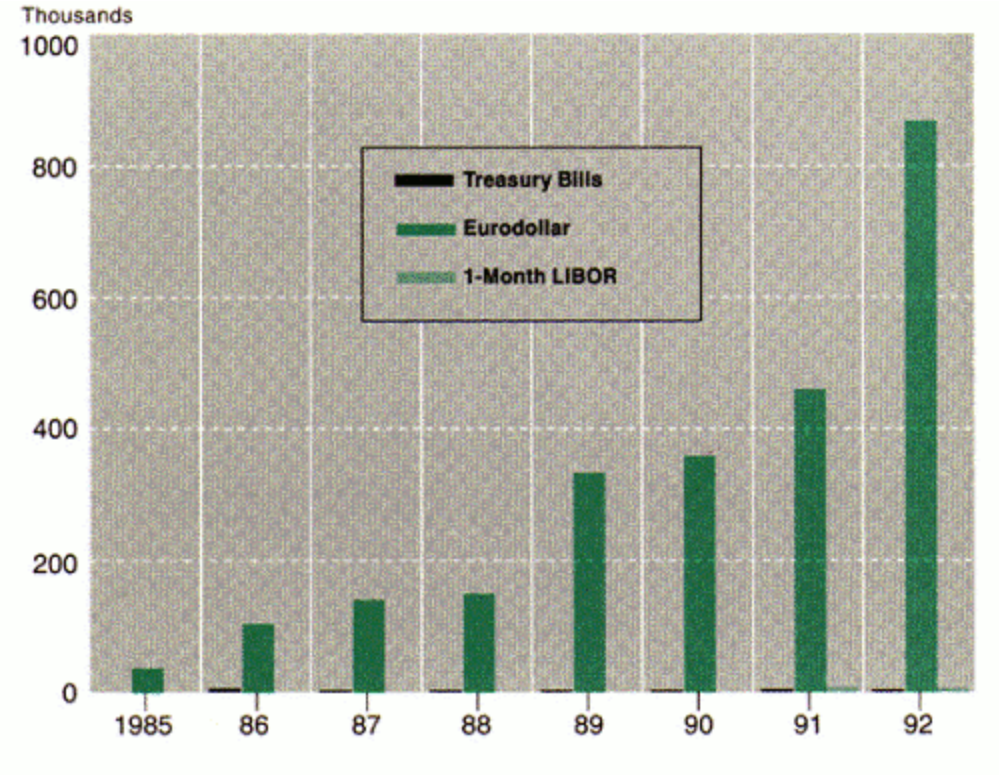


FIGURE 2

Average Month-End Open Interest

U.S. Money Market Options



As the two figures show, trading activity in Eurodollar futures options dwarfs that of the other two contracts. The popularity of Eurodollar futures options reflects the trading volume in the underlying futures contract, which is correspondingly higher than that of any other futures contract on money market instruments.

OPTION PAYOFFS AND THE BEHAVIOR OPTION PRICES

This section reviews some basic principles of option pricing. The review begins by describing the payoff patterns resulting from different unhedged positions in futures contracts and futures options and concludes with a brief discussion of the theory of option pricing

Payoff Diagrams The payoff diagrams depicted in Figures 3-5 illustrate the cash flows resulting from positions in futures contracts and futures options as a

function of the futures price on the contract expiration date. An analysis of payoff diagrams for futures contracts provides a useful starting point for the subsequent study of put and call option payoffs.

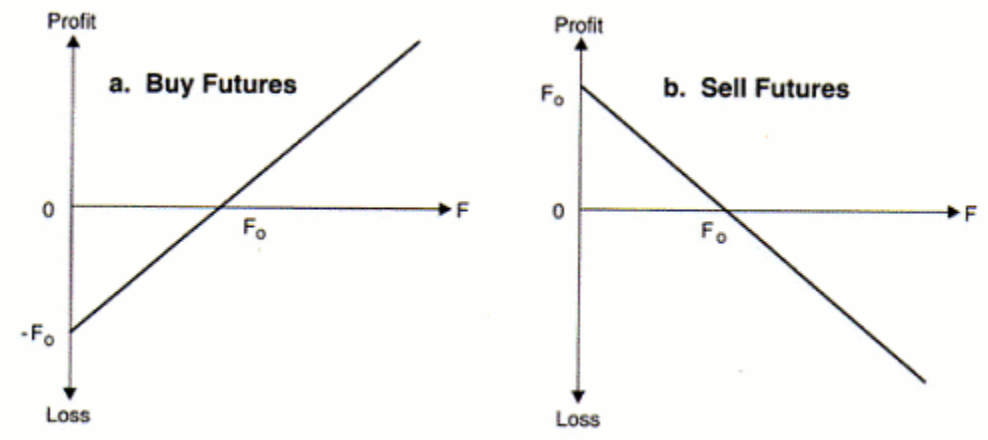
Futures Contracts Figure 3a shows the payoff at maturity to an unhedged long position in a futures contract. The horizontal axis measures the futures price *F* while the vertical axis measures the profit or loss resulting from a change in the futures price. A long futures position earns or loses $1 with each corresponding $1 increase or decrease in the futures price. Thus, if F_0 is the initial futures price and *F* is the final settlement price, the payoff to a long futures position held to maturity is just $F - F_0$, which is depicted by a 45 degree line intersecting the horizontal axis at F_0 in Figure 3a.

The payoff to an unhedged short futures position is $F_0 - F$, which, as Figure 3b illustrates, is just the opposite of the payoff to a long futures position. From Figure 3 it should be clear that selling a futures contract exactly offsets or cancels the exposure resulting from a long futures position maturing on the same date.

Long Call Option A call option is said to be in-the-money when the market price of the underlying instrument is above the strike price, out-of-the-money when the market price is below the strike price, and at-the-money when the market price just equals the strike price. The amount an option holder could earn by exercising the option is termed the intrinsic value of the option. An out-of-the-money option has no intrinsic value and will not be exercised. The

FIGURE 3

Payoffs for Unhedged Futures Contracts



intrinsic value of an in-the-money American call option is determined by the difference between the current market price of the underlying instrument and the option strike price. Let F denote the underlying futures price and K the option strike price. Then, the intrinsic value of a futures call option is $F - K$ if $F > K$ and zero if $F \leq K$, which can be written as

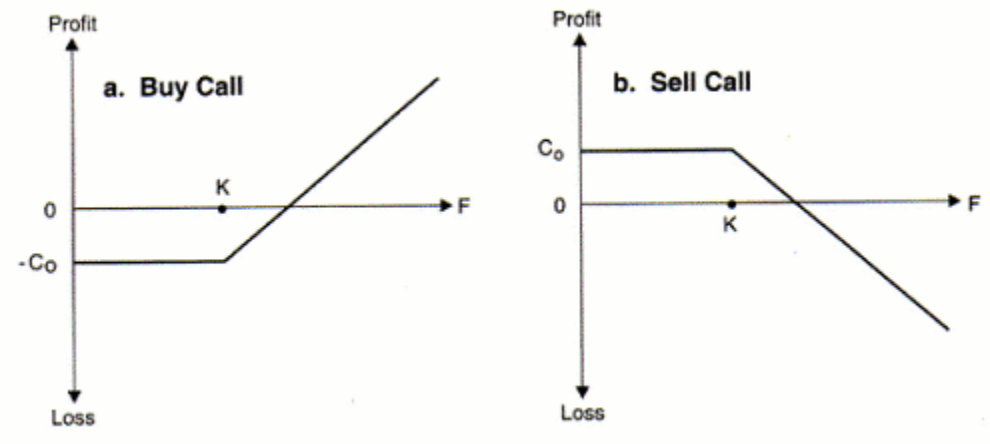
$$\max(0, F - K).$$

Figure 4a illustrates the payoff to a long call option held to expiration. Let C_0 denote the call premium paid at the time the option was first purchased. If $F < K$, the option will expire out-of-the-money and the buyer will lose the call premium. But the call premium is the most the option holder can lose, so that the payoff diagram has a floor at $-C_0$ on the vertical axis. When the underlying futures price is above the option strike price, the call holder can earn a marginal profit of $F - K$ by exercising the option, so the payoff line is kinked at $F = K$, the point where the option goes in-the-money. The total net profit accruing to a long call option position when the option expires in-the-money is $F - K - C_0$. The payoff line intersects the horizontal axis at the break-even price $F = K + C_0$.

To illustrate, consider the payoff to a call option on September Treasury bill futures with a strike price of 96.00 bought at a premium of 30 basis points ($750). If the underlying futures contract is priced below 96.00 when the option expires, the option expires out-of-the-money and the buyer loses the entire $750 premium. At any futures price above 96.00 the option is in-the-money, so a holder can exercise the option and liquidate the resulting futures position to

FIGURE 4

Payoffs for Unhedged Call Options



earn a marginal profit. For example, if Treasury bill futures are priced at 96.25 the option's intrinsic value is 25 basis points ($625). By exercising the option and immediately selling the underlying futures contract, an option holder can earn a total net profit of 96.25 - 96.00 - 0.30 =
- 0.05, or - $125. The break-even price is 96.30.

Short Call Option Figure 4b depicts the payoff at expiration for an unhedged short position in a call option. If $F < K$ the option expires out-of-the-money and the seller earns the premium C_0. The payoff line is kinked at $F = K$, the point where the option is just at-the-money. When $F > K$ the option will be exercised and the net payoff to the seller will be $K + C_0 - F$. The net profit is negative if the loss on the sale of the underlying item exceeds the premium earned when the call was sold; that is, if $F - K > C_0$.

Long Put Option A put option is in-the-money when the market price of the underlying instrument is below the strike price and out-of-the-money when it is above the strike price. If $F > K$ the option expires out-of-the-money and the buyer loses the put premium. When $F < K$ the option is in-the-money and the buyer earns a marginal positive profit of $K - F$ by exercising the option. Thus, the intrinsic value of a put option can be written as

$$\max(0, K - F).$$

Figure 5a depicts the net payoff at expiration to a long position in a futures put option. Suppose a buyer pays a put premium P_0 in exchange for the right to sell the underlying futures contract at the strike price K. Then, the net profit from exercising an in-the-money put option is $K - F - P_0$,which is positive when F is less than the break-even price $K - P_0$.

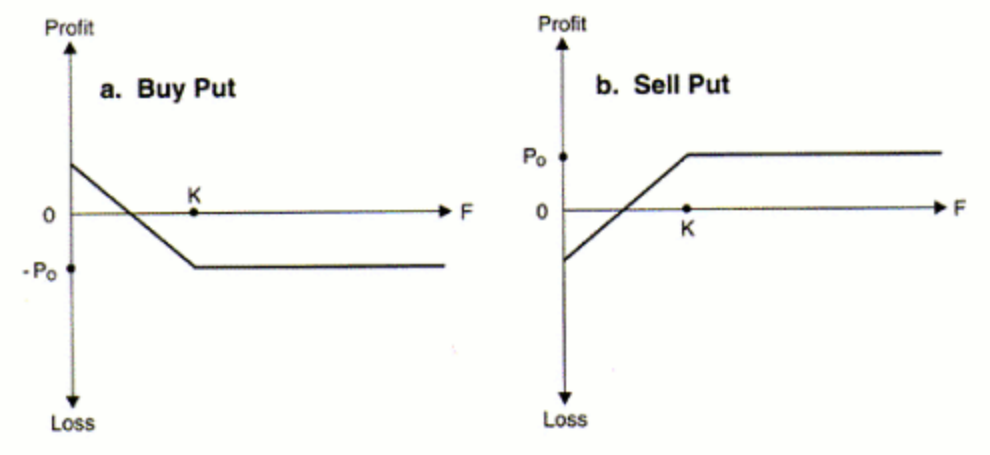
To illustrate, consider the payoff at expiration to a June Eurodollar futures put option. Suppose a put option with a strike price of 96.00 sells for a premium of 7 basis points, or $175. If the final settlement price is 95.80, the option is in-the-money and exercising it yields a payoff of $500 (20 basis points x $25 per basis point). The net profit is 13 basis points (96.00 - 95.80 - 0.07), or $325. The break-even price is 96.00 - 0.07 = 95.93.

Short Put Option Finally, Figure 5b depicts the payoff at expiration to a short position in a put option. When the option expires out-of-the-money, the writer earns the put premium P_0. If the option is in-the-money, the net profit (or loss) is $P_0 + F - K$, the put premium less the difference between the strike price and the cash market price of the underlying item on that date.

As a final observation, note that buying a put does not offset the exposure to a long call position. Instead, a long position in a call option is offset by selling a call with the same strike price and expiration date. Similarly, a long put position is offset by selling a put with the same contract specifications.

FIGURE 5

Payoffs for Unhedged Put Options



Principles of Option Pricing

The Time Value of an Option An out-of-the-money option typically will sell for a positive premium before the contract expiration date because there is always some chance that the option will go in-the-money before it expires. The excess of an option premium over its intrinsic value is termed its time value, or speculative value. All other things equal, the time value of an option tends to increase with the time to expiration because a longer-lived option has a greater chance of going deeper in-the-money before it expires. At expiration time value is zero and the only value the option has is its intrinsic value. The rate at which an option premium changes over time, with all other things held equal, is known as the "theta" of the option. Option pricing theory predicts that theta should be negative, reflecting the fact that time value is expected to fall as the expiration date draws nearer.

Table 1 lists call prices, underlying futures prices, and time values for IMM Eurodollar futures call options with different expiration dates as of the close of trading on October 21, 1992. Looking at the first row, a December Eurodollar futures call option with a strike price of 96.00 sold for a premium of 51 basis points, while the price of the underlying futures contract at the end of the same trading session was 96.44. Thus, the intrinsic value of the December option was 44 basis points. The difference between the call premium and its intrinsic value was 7 basis points, or $175. Notice that the time values listed in Table 1 are larger for options with more distant expiration dates.

TABLE 1

Eurodollar Futures Call Option Premiums,

Intrinsic Values, and Time Values

Expiration Month	Strike Price	Premium	Futures Price	Intrinsic Value	Time Value
December 1992	96.00	0.51	96.44	0.44	0.07
March 1993	96.00	0.55	96.36	0.36	0.19
June 1993	96.00	0.39	95.91	0.00	0.39

Strike Prices and Option Premiums All other things equal, a call option should be more valuable the lower its strike price. With the price of the underlying item held fixed, a lower strike price increases the intrinsic value of an in-the-money call option and makes it more likely that an out-of-the-money call will go in-the- money before expiring. The opposite is true for put options, which become more valuable the higher the strike price. These predicted price patterns are evident in Table 2, which lists call and put premiums for December Eurodollar futures as of the close of trading on October 21, 1992.

Responsiveness of Option Premiums to Changes in Underlying Futures Prices A similar line of reasoning leads to the prediction that a futures call should become more valuable the higher the underlying futures price, all other things equal, while a futures put should become more valuable when the underlying futures price falls. The responsiveness of an option's premium to a change in the price of the underlying item is known as the option "delta." The relationship between the strike price and the price of the underlying item influences the value of delta. The value of an option that is deep in-the-money is determined largely by its intrinsic value. In this case, a change in the price of the underlying item can affect the value of the option by an almost equal amount, so delta is close

TABLE 2

Selected Call and Put Premiums for

Options on Eurodollar Futures

	Strike Price					
	96.00	**96.25**	**96.50**	**96.75**	**97.00**	**97.**
Calls	0.51	0.33	0.19	0.09	0.04	0.0
Puts	0.07	0.14	0.25	0.40	0.60	0.8

to one. When an option is far out-of-the-money, a change in the price of the underlying item may have little effect on the option premium—delta is close to zero in this latter case. Option deltas also vary with time to expiration.

Price Volatility and Option Premiums Option pricing theory predicts that an option should be more valuable the higher the price volatility of the underlying item. To understand why this should be so, consider the payoff to holding a long position in a call option. A call option becomes more valuable when the price of the underlying item increases, so the greater the price volatility of the underlying item the more likely that the payoff to a call option will increase some time before it expires. Of course, increased volatility also makes it more likely that the price of the underlying item will fall, but the losses faced by the buyer of a call option are limited to the amount of the call premium whereas potential gains are virtually unlimited. Thus, increased price volatility should make a call option more valuable. A similar line of reasoning applies to put option premiums. The responsiveness of an option premium to changes in expected volatility is termed the "lambda" of the option.[3]

>Br ? ***Put-Call Parity*** As the foregoing discussion has illustrated, the same underlying factors determine put and call premiums: the option strike price and expiration date, market interest rates, the price of the underlying instrument, and expected price volatility. Accordingly, it should not be surprising to find that certain predictable relationships exist between put and call premiums. A fundamental relationship between put and call premiums for European-style options is known as put-call parity.

The put-call parity formula for European-style futures options is

$$C - P = (F - K)/[1 + r(T/360)],$$

where r is the risk-free interest rate expressed as an annualized money market rate and T is the time to expiration for the call and put options on a given futures contract. Put-call parity equates the difference between the call and put premiums with the present value of the difference between the current underlying futures price and the exercise price. Given the call premium for a European option, its strike price, time to maturity, and underlying futures price, the put-call parity formula determines the premium for a corresponding European put option with the same strike price and expiration date. Conversely, the put premium, strike price, underlying futures price, and expiration date determine the call premium on a European option with the same strike price and expiration date.

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[3] The terms "kappa," "sigma," or "vega" are sometimes used instead of lambda.

The put-call parity relation derives from the fact that the simultaneous purchase of a call and sale of a put with the same strike price and expiration date produces the same payoff at expiration as a long position in the underlying futures contract purchased at the strike price *K*. To see this, recall that the value of an option at expiration is just its intrinsic value, so at expiration

$$C = \max(0, F - K),$$

and

$$P = \max(0, K - F).$$

If $F > K$ the call option expires in-the-money and the option holder earns $F - K$, while if $F < K$ the put option expires in-the-money and the option writer earns a negative profit equal to $F - K$. Thus, upon expiration the payoff to a combined long position in a call option and a short position in a put option is always $F - K$, meaning that $C - P = F - K$, which is just the put-call parity formula given above evaluated at $T = 0$. But $F - K$ is the payoff to a long position in the underlying futures contract bought at a price *K*. Thus, buying a call while selling a put with the same strike price and expiration date just replicates the return to a long position in the underlying futures contract. This result is illustrated in Figure 6.[4]

In theory, put-call parity applies only to European options. The relationship need not be exact with American options because there are circumstances under which an option holder has an incentive to exercise a futures option before expiration. As a practical matter, however, the approximation can be quite close. (See Kawaller [1988].) Put-call parity can be used to help characterize payoffs to combined positions in options and the underlying item. For example, a common options hedging strategy involves buying a put option to protect against the risk of a drop in the price of the underlying item. Rearranging terms in the put-call parity formula shows that the payoff at expiration for such a position will be $C = P + (F - K)$; that is, a long position in both a futures put option and the underlying futures contract creates a "synthetic" long call option. Thus, buying a call option can substitute for buying the underlying instrument and hedging the resulting risk of loss by buying a put option. Conversely, a short position in a futures put combined with a short position in the underlying futures contract creates a synthetic short position in the corresponding futures call option. The put-call parity formula can be used to determine the value of the resulting synthetic call.

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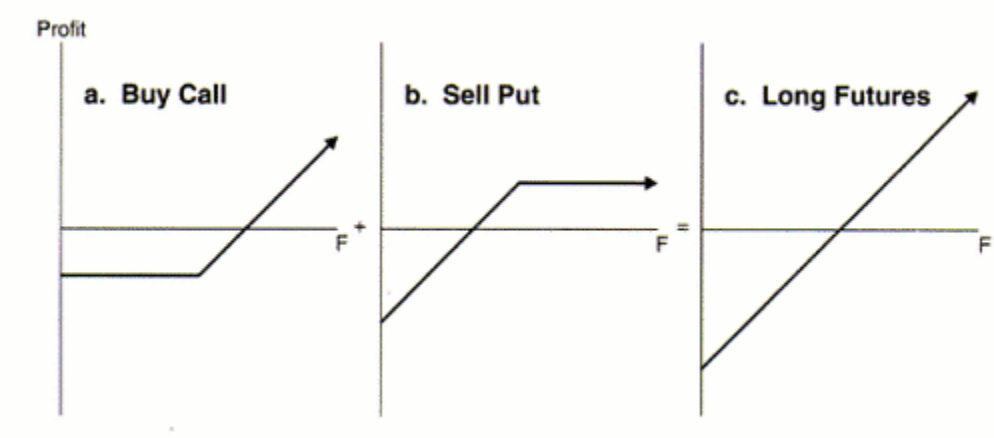
[4] See Chance (1989, Chap. 12) or Hull (1989, Chap. 6) for a more rigorous derivation of put-call parity for futures options.

FIGURE 6

Put-Call Parity



As another example, consider the payoff associated with a short position in a futures contract together with a long position in a call option on that contract. According to the put-call parity formula, the payoff at expiration for such a position would be $P = C - (F - K)$, which says that such a hedging strategy creates a synthetic long put option on the futures contract. The ensuing discussion of option hedging strategies makes use of these results.

HEDGING WITH INTEREST RATE FUTURES OPTIONS

An option hedge combines a position in an option with a position in the underlying item in such a way that either the option protects the underlying item against loss or the position in the underlying item helps to offset losses resulting from the option. This section presents examples of two basic hedging strategies for options on money market futures.

Hedging Investment Returns—Creating an Interest Rate Floor

Buying a call option on an interest rate futures contract establishes a maximum purchase price for the futures contract, thereby establishing a maximum purchase price for the underlying interest-bearing security. Since the price of an interest-bearing security varies inversely with market interest rates, establishing a maximum purchase price amounts to fixing a minimum yield on the anticipated investment. The following example illustrates the mechanics of a hedge undertaken to fix a minimum yield, or interest rate "floor," on a planned investment.

Suppose that on April 1 an investment fund manager learns that the fund will receive a $1 million cash inflow in June. The manager plans to invest these funds

in a three-month Treasury bill but is concerned that market interest rates might fall in the intervening period, resulting in a lower future return on the planned investment. He can fix a minimum interest rate on the planned investment either by (1) buying a Treasury bill futures contract or (2) buying a futures call option.

Result of a Futures Hedge Suppose the fund manager buys a June Treasury bill futures contract at 95.89 to lock in a discount yield of 4.11 percent when the contract matures on June 24. Fixing the future return in this manner carries two potential disadvantages. First, the fund forgoes the opportunity to earn a higher return if interest rates rise. Second, the futures hedge exposes the fund to the risk of margin calls before it receives the expected inflow of funds.

An Option Hedge Alternatively, the fund manager could buy a call option on June Treasury bill futures. Suppose a call option on June Treasury bill futures with a 95.50 strike price can be bought for a premium of 40 basis points. The effective maximum purchase price established by the strategy of buying a futures call in this case is 95.90, the total of the strike price and the call premium, resulting in an investment floor of 4.10 percent.

The mechanics of the option hedge in this example are complicated by the fact that Treasury bill futures options expire approximately one month before the underlying futures contract matures. Options on June 1992 Treasury bill futures, for example, expire on May 15. If the option expires in-the-money, the fund manager would need to exercise the option and hold the resulting long futures position to maturity in June to assure the 4.10 percent investment floor. If interest rates rise and the option expires out-of-the-money, however, the manager would again face the risk that rates might decline during the month-long period between the May 15 option expiration date and the date the bill is to be purchased in June.

There are at least three ways the hedger in this example can minimize the risk exposure resulting from an option expiring out-of-the-money. First, he can reduce the probability of such an event by buying an option that is deep in-the-money. Such a strategy reduces the opportunity to earn a higher return in the event of a rise in market interest rates, however, and so may not offer a hedger any significant advantages over a simple futures hedge. Second, if the option does expire out-of-the-money, the fund can buy a Treasury bill futures contract to lock in the higher interest rate prevailing on the option expiration date. Finally, the hedger could buy an option on September Treasury bill futures and sell the option on the transaction date. A hedger pursuing this latter strategy would be exposed to "basis risk," however, because the option would need to be sold before expiration, and changes in the value of the option do not always correlate perfectly with changes in spot Treasury bill rates. As a result, such a hedge could not assure a minimum future investment rate with certainty. Basis risk can arise

whenever the expiration date on an option used to hedge some underlying risk differs from the planned transaction date.

Figure 7 depicts the payoff at expiration to the option hedge described above under the assumption that the hedger always takes on a long position in June Treasury bill futures once the option expires and holds it to maturity. Since the investment fund could fix the future investment rate at 4.11 percent by buying a futures contract on April 1, it can be viewed as having an inherent, or unhedged, exposure equivalent to being short a June Treasury bill futures contract. Accordingly, the fund's inherent exposure can be expressed as

$$-(F - 95.89).$$

Figure 7a illustrates the fund's inherent exposure as a function of June Treasury bill futures prices. If the fund remains unhedged its profitability will vary directly with market interest rates, falling when market interest rates fall (thereby driving up Treasury bill prices) and rising when interest rates rise.

Taking on a long position in a 95.50 strike price call option on Treasury bill futures that sells for a premium of 0.40 produces a net profit at expiration of

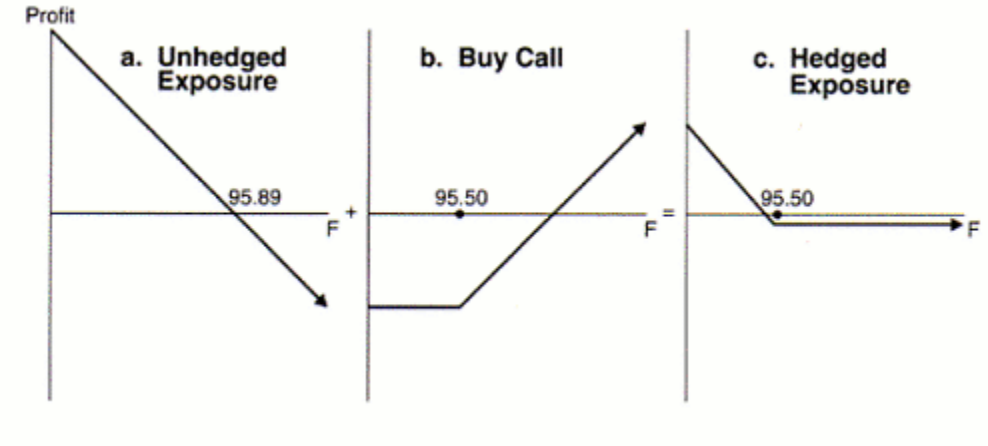
$$\max(0, F - 95.50) - 0.40.$$

Figure 7b depicts this net profit as a function of underlying futures prices. The buyer loses the entire 40 basis point call premium if Treasury bill futures prices fall below the 95.50 strike price—that is, if the Treasury bill futures discount rate rises above 4.50 percent. When futures prices are above the strike price the

FIGURE 7

Using an Interest Rate Futures Call Option

to Hedge a Planned Investment



option offers a payoff similar to the payoff to a futures contract, except that the returns earned by the option holder are reduced by the 40 basis point option premium. The break-even price is 95.90.

Combining the purchase of a call option with the short inherent exposure in the underlying futures contract effectively creates a synthetic put option, illustrated in Figure 7c. To understand why, consider the effect that buying a call option has on the fund's profits. The fund's hedged profits are determined by the sum of the last two expressions:

$$-(F - 95.89) + \max(0, F - 95.50) - 0.40.$$

When $F < 95.50$ the call option expires out-of-the money. In this case the intrinsic value of the option is zero so that the hedged return is

$$-(F - 95.49),$$

which is just the same as the unhedged payoff less the 40 basis point option premium. When $F \geq 95.50$ the option expires in-the-money and the return earned by the fund is

$$-(F - 95.89) + (F - 95.50) - 0.40 = -0.01.$$

These last two results can be combined and the resulting payoff to the hedged position can be compactly written as

$$\max(0, 95.50 - F) - 0.01,$$

which is the net payoff at expiration to buying a Treasury bill futures put option with a strike price of 95.50 at a premium of 1 basis point.

Thus, combining the purchase of a call option with an inherent short position in the underlying futures contract effectively creates a synthetic put option. The implicit premium on the synthetic put is determined by the difference between the 4.11 percent rate that could have been locked in by buying a futures contract and the 4.10 percent floor rate established by buying a Treasury bill futures call option. Notice that the implicit premium on the synthetic put, which is out-of-the money at the time the hedge is created, is just equal to the time value of the explicit call option premium. The implicit premium is quite small in this example, costing only one basis point, or $25. In most cases, however, one would expect the implicit premium to be greater.

Hedging Borrowing Rates—Creating an Interest Rate Cap Buying a put option on an interest rate futures contract establishes a minimum sales price for the underlying futures contract, thereby fixing a minimum sales price for the underlying interest-bearing security. Since fixing a minimum sales price on an interest-bearing security amounts to fixing a maximum interest rate on that security, buying a put option on an interest rate futures contract can effectively establish a maximum borrowing rate on a variable-rate loan indexed to market

interest rates. If interest rates fall before the loan is taken out the hedger loses all or part of the put premium, but can borrow at the new, lower market rate. If interest rates rise, the option payoff offsets the added interest rate expense.

As an example, suppose that on March 16 a firm takes out a floating-rate loan priced at 2.0 percentage points over three-month LIBOR, and assume that the interest rate on the loan is scheduled to be reset on June 15, the same date that June Eurodollar futures and futures options expire. The firm's treasurer, concerned that market rates might rise, decides to hedge future borrowing costs.

A Futures Hedge Suppose a June Eurodollar futures contract can be sold at a price of 95.14, corresponding to a futures LIBOR of 4.86 percent. The total hedged borrowing cost in this case would be 6.86 (4.86 LIBOR + 2.00 margin) percent.

An Option Hedge Now consider the strategy of buying a Eurodollar futures put option. Suppose the firm purchases an out-of-the-money put option with a strike price of 95.00 at a premium of 17 basis points. Buying a Eurodollar futures put with a strike price of 95.00 fixes a maximum LIBOR of 5.00 percent, thereby fixing an effective maximum borrowing rate of 7.00 percent. The option premium adds 17 basis points to the cost of hedge, so the ultimate effective "cap" rate obtained through this strategy is 7.17 percent.

Figure 8 illustrates the effect of the option hedge on the firm's profits. Without hedging, the firm implicitly is long a Eurodollar futures contract because, as noted above, it could hedge its exposure to changes in market interest rates by selling a contract. Thus, the firm's inherent, or unhedged, exposure can be characterized by the expression

$$F - 95.14.$$

Figure 8a illustrates the firm's inherent, or unhedged, exposure as a function of Eurodollar futures prices.

The net profit at expiration to a long position in a 95.00 strike price Eurodollar futures put option bought at a premium of 17 basis points is

$$\max(0, 95.00 - F) - 0.17.$$

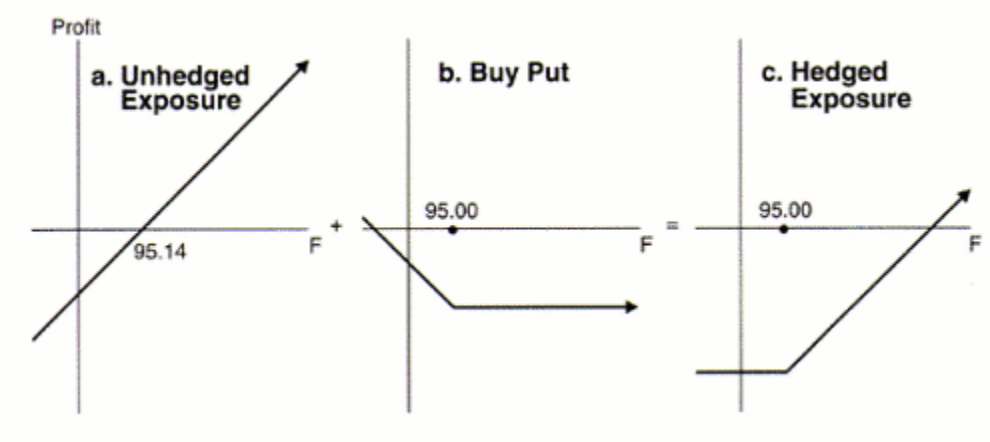
Figure 8b illustrates this payoff as a function of the underlying Eurodollar futures price index. The put premium subtracts 17 basis points from any payoff earned by exercising the option so the break-even price is $F = 94.83$.

Figure 8c depicts the firm's hedged profits as a function of Eurodollar futures prices. This illustration shows how combining a long position in a put option with the inherent short position in the underlying futures contract creates a

FIGURE 8

Using an Interest Rate Futures Put Option

to Hedge Borrowing Rates



synthetic Eurodollar futures call option. As before, the hedged payoff is obtained by summing the option payoff and the inherent exposure:

$$(F - 95.14) + \max(0, 95.00 - F) - 0.17.$$

When $F \leq 95.00$ the option expires in-the-money and the return to the hedged position is

$$(F - 95.14) + (95.00 - F) - 0.17 = -0.31.$$

If $F > 95.00$ the option expires out-of-the-money and the return to the hedged position is characterized by

$$(F - 95.14) - 0.17 = F - 95.31.$$

Combining these two results yields the expression

$$\max(0, F - 95.00) - 0.31,$$

which is the net payoff to a Eurodollar futures call option with a strike price of 95.00 bought for an implicit premium of 31 basis points.

The implicit premium is determined by the difference between the 5.17 percent cap rate established by buying the put option and the 4.86 percent interest rate that could have been locked in by selling a futures contract. This implicit premium reflects the sum of the cost of the purchased put option (0.17) and difference between the prevailing futures price and the strike price (95.14 - 95.00 = 0.14), the latter term being the intrinsic value of the synthetic

call. The return earned using the option hedge is greater than the return to the futures hedge when LIBOR falls below 4.69 percent, which is just the 4.86 percent futures rate less the 17 basis point put premium.

CONCLUDING COMMENTS

Options can be viewed as basic building blocks that can be combined to replicate an almost endless variety of payoff patterns. This chapter has focused on futures options. However, the use of option-like derivatives in the money market is not limited to options on interest rate futures. In addition to exchange-traded options, custom-tailored over-the-counter interest rate options—known as caps, collars, and floors—have become increasingly popular in recent years. The basic concepts examined in this chapter provide the background necessary to understand the uses of these new instruments, which are discussed in the next chapter.

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Chapter 16
OVER-THE-COUNTER INTEREST RATE DERIVATIVES

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INTRODUCTION

Over-the-counter (OTC) interest rate derivatives include instruments such as forward rate agreements (FRAs), interest rate swaps, caps, floors, and collars. Broadly defined, a derivative instrument is a formal agreement between two parties specifying the exchange of cash payments based on changes in the price of a specified underlying item or differences in the returns to different securities. Like exchange-traded interest rate derivatives such as interest rate futures and futures options, OTC interest rate derivatives set terms for the exchange of cash payments based on changes in market interest rates. An FRA is a forward contract that sets terms for the exchange of cash payments based on changes in the London Interbank Offered Rate (LIBOR); interest rate swaps provide for the exchange of payments based on differences between two different interest rates; and interest rate caps, floors, and collars are option-like agreements that require one party to make payments to the other when a stipulated interest rate, most often a specified maturity of LIBOR, moves outside of some predetermined range.

The over-the-counter market differs from futures markets in a number of important respects. Whereas futures and futures options are standardized agreements that trade on organized exchanges, the over-the-counter market is an informal market consisting of dealers, or market makers, who trade price information and negotiate transactions over electronic communications networks. Although a great deal of contract standardization exists in the over-the-counter market, dealers active in this market custom-tailor agreements to meet the specific needs of their customers. And unlike futures markets, where futures exchange clearinghouses guarantee contract performance through a system of margin requirements combined with the daily settlement of gains or losses, counterparties to OTC derivative agreements must bear some default or credit risk.

The rapid growth and energized pace of innovation in the market for interest rate derivatives since 1981, the date of the first widely publicized swap agreement, has proven truly phenomenal. The advent of trading in interest rate swaps was soon followed by FRAs, caps, floors, collars, as well as other hybrid instruments

such as forward swaps, options on swaps (swaptions), and even options on options (captions).

This chapter offers an introduction to OTC interest rate derivatives. The first five sections describe some of the most common types of OTC derivatives: FRAs, interest rate swaps, caps, floors, and collars. The final section discusses policy and regulatory concerns prompted by the growth of the OTC derivatives market.

FORWARD RATE AGREEMENTS

FRAs are cash-settled forward contracts on interest rates traded among major international banks active in the Eurodollar market. An FRA can be viewed as the OTC equivalent of a Eurodollar futures contract. Most FRAs trade for maturities corresponding to standard Eurodollar time deposit maturities, although nonstandard maturities are sometimes traded (Grabbe 1991, Chap. 13). Trading in FRAs began in 1983 (Norfield 1992).

Banks use FRAs to fix interest costs on anticipated future deposits or interest revenues on variable-rate loans indexed to LIBOR. A bank that sells an FRA agrees to pay the buyer the increased interest cost on some "notional" principal amount if some specified maturity of LIBOR is above a stipulated "forward rate" on the contract maturity or settlement date. The principal amount of the agreement is termed "notional" because, while it determines the amount of the payment, actual exchange of the principal never takes place. Conversely, the buyer agrees to pay the seller any decrease in interest cost if market interest rates fall below the forward rate. Thus, buying an FRA is comparable to selling, or going short, a Eurodollar or LIBOR futures contract.

The following example illustrates the mechanics of a transaction involving an FRA. Suppose two banks enter into an agreement specifying:

- a forward rate of 5 percent on a Eurodollar deposit with a three-month maturity;
- a $1 million notional principal; and
- settlement in one month.

Such an agreement is termed a 1x4 FRA because it fixes the interest rate for a deposit to be placed after one month and maturing four months after the date the contract is negotiated. If the three-month LIBOR is 6 percent on the contract settlement date, the seller would owe the buyer the difference between 6 and 5 percent interest on $1 million for a period of 90 days. Every 1 basis point change in the interest rate payable on a principal of $1 million for a 90-day maturity changes interest cost by $25, so that the increase in the interest cost on a three-month Eurodollar deposit over the specified forward rate in this case is $25 x 100 basis points = $2,500. But the interest on a Eurodollar deposit is paid upon maturity (at the end of the term of the deposit), whereas FRAs

are settled on the contract maturity date (which would correspond to the date the underlying hypothetical deposit would be placed). Therefore, to make the cash payment on the FRA equivalent to the extra interest that would have been earned on a Eurodollar deposit paying 6 percent, the $2,500 difference in interest costs calculated above is discounted back three months using the actual three-month LIBOR prevailing on the settlement date. Thus, if 90-day LIBOR turns out to be 6 percent on the contract maturity date the buyer would receive

$$\$2,463.05 = \$2,500/[1 + 0.06(90/360)].$$

More generally, final settlement of the amounts owed by the parties to an FRA is determined by the formula

$$\text{Payment} = (N)(LIBOR - FR)(dtm/360)/1 + LIBOR(dtm/360) ,$$

where

N = the notional principal amount of the agreement;

$LIBOR$ = the value of LIBOR for the maturity specified by the contract prevailing on the contract settlement date;

FR = the agreed-upon forward rate; and

dtm = maturity of the forward rate, specified in days.

If $LIBOR > FR$ the seller owes the payment to the buyer, and if $LIBOR < FR$ the buyer owes the seller the absolute value of the payment amount determined by the above formula.

INTEREST RATE SWAPS

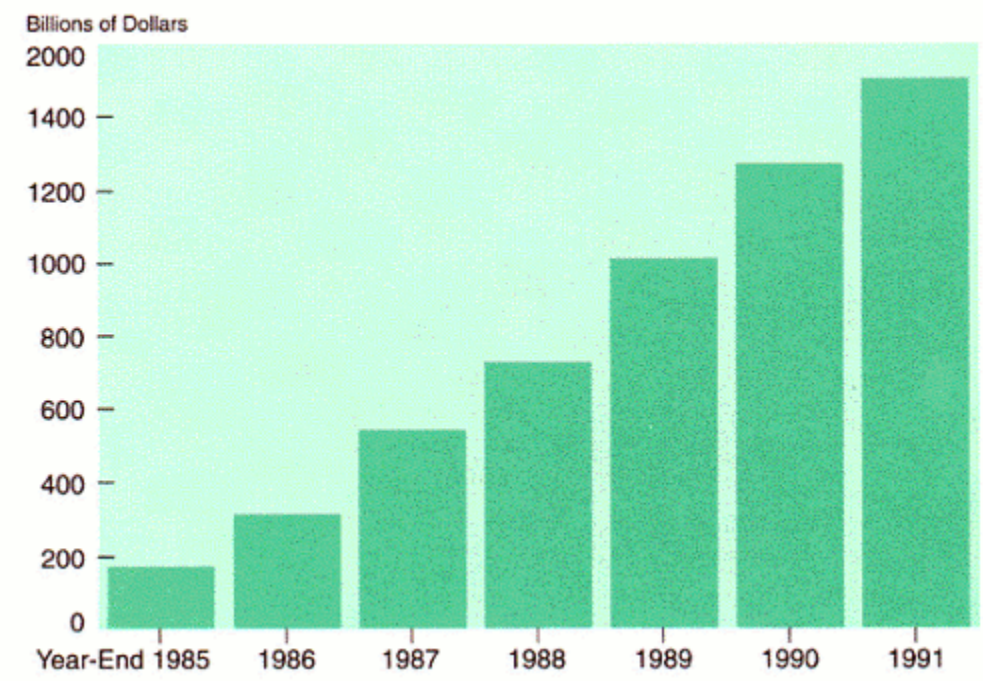
A swap is a contractual agreement between two parties to exchange, or "swap," future payment streams based on differences in the returns to different securities or changes in the price of some underlying item. Interest rate swaps constitute the most common type of swap agreement. In an interest rate swap, the parties to the agreement, termed the swap counterparties, agree to exchange payments indexed to two different interest rates. Total payments are determined by the specified notional principal amount of the swap, which is never actually exchanged. Financial intermediaries, such as banks, pension funds, and insurance companies, as well as nonfinancial firms use interest rate swaps to effectively change the maturity of outstanding debt or that of an interest-bearing asset.[1]

Swaps grew out of parallel loan agreements in which firms exchanged loans denominated in different currencies. Although some swaps were arranged in the late 1970s, the first widely publicized swap took place in 1981 when IBM and the World Bank agreed to exchange interest payments on debt denominated in

[1] See Wall and Pringle (1988) for a more comprehensive survey of market participants.

FIGURE 1

U.S. Dollar Interest Rate Swaps



Source: *Market Survey Highlights, Year End 1991,* International Swap Dealers Association, Inc.

different currencies, an arrangement known as a currency swap. The first interest rate swap was a 1982 agreement in which the Student Loan Marketing Association (Sallie Mae) swapped the interest payments on an issue of intermediate-term, fixed-rate debt for floating-rate payments indexed to the three-month Treasury bill yield. The interest rate swap market has grown rapidly since then. Figure 1 displays the year-end total notional principal of U.S. dollar interest rate swaps outstanding from 1985 to 1991. Based on market survey data published by the International Swap Dealers Association (ISDA), U.S. dollar interest rate swaps comprise about one-half of all interest rate swaps outstanding: the notional principal amount of U.S. dollar interest rate swaps outstanding as of the end of 1991 was just over $1.5 trillion, compared to almost $3.1 trillion for all interest rate swaps.

Swap Dealers Early interest rate swaps were brokered transactions in which financial intermediaries with customers interested in entering into a swap would seek counterparties for the transaction among their other customers. The intermediary collected a brokerage fee as compensation, but did not maintain a

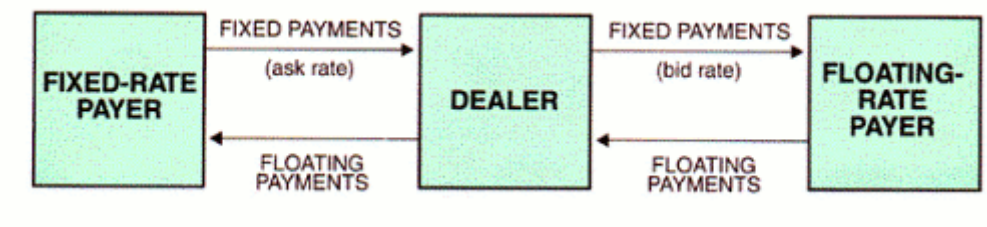
continuing role once the transaction was completed. The contract was between the two ultimate swap users, who exchanged payments directly.

Today the market has evolved into more of a dealer market dominated by large international commercial and investment banks. Dealers act as market makers that stand ready to become a counterparty to different swap transactions before a customer for the other side of the transaction is located. A swap dealer intermediates cash flows between different customers, or "end users," becoming a middleman to each transaction. The dealer market structure relieves end users from the need to monitor the financial condition of many different swap counterparties. Because dealers act as middlemen, end users need only be concerned with the financial condition of the dealer, and not with the creditworthiness of the other ultimate end user of the instrument (Brown and Smith 1990).

Figure 2 illustrates the flow of payments between two swap end users through a swap dealer. Unlike brokers, dealers in the over-the-counter market do not charge a commission. Instead, they quote two-way "bid" and "asked" prices at which they stand ready to act as counterparty to their customers in a derivative instrument. The quoted spread between bid and asked prices allows an intermediary to receive a higher payment from one counterparty than is paid to the other.

FIGURE 2

The Dealer Market for Interest Rate Swaps



Swap Market Conventions There are many different variants of interest rate swaps. The most common is the fixed/floating swap in which a fixed-rate payer makes payments based on a long-term interest rate to a floating-rate payer, who, in turn, makes payments indexed to a short-term money market rate to the fixed-rate payer. A fixed/floating swap is characterized by:

- a fixed interest rate;
- a variable or floating interest rate which is periodically reset;
- a notional principal amount upon which total interest payments are based; and

- the term of the agreement, including a schedule of interest rate reset dates (that is, dates when the value of the interest rate used to determine floating-rate payments is determined) and payment dates.

The fixed interest rate typically is based on the prevailing market interest rate for Treasury securities with a maturity corresponding to the term of the swap agreement. The floating rate is most often indexed to three- or six-month LIBOR, in which case the swap is termed a "generic" or "plain vanilla" swap, but can be indexed to almost any money market rate such as the Treasury bill, commercial paper, federal funds, or prime interest rate. The maturity, or "tenor," of a fixed/floating interest rate swap can vary between 1 and 15 years. By convention, a fixed-rate payer is designated as the buyer and is said to be long the swap, while the floating-rate payer is the seller and is characterized as short the swap.

Timing of Payments A swap is negotiated on its "trade date" and takes effect two days later on its initial "settlement date." If the agreement requires the exchange of cash at the outset, as in the case of a "nonpar" swap, the transaction takes place on the initial settlement date. Interest begins accruing on the "effective date" of the swap, which usually coincides with the initial settlement date. (Forward swaps, in which the effective date of the swap is deferred, are an exception to this rule.) Floating-rate payments are adjusted on periodic "reset dates" based on the prevailing market-determined value of the floating-rate index, with subsequent payments made on a sequence of payment dates (also known as settlement dates) specified by the agreement. Typically, the reset frequency for the floating-rate index is the term of the interest rate index itself. For example, the floating rate on a generic swap indexed to the six-month LIBOR would, in most cases, be reset every six months with payment dates following six months later. The floating rate can be reset more frequently, however, as in the case of swaps indexed to Treasury bill rates, which are reset weekly.

Fixed interest payment intervals can be three months, six months, or one year. Semiannual payment intervals are most common because they coincide with the intervals between interest payments on Treasury bonds. Floating-rate payment intervals need not coincide with fixed-rate payment intervals, although they often do. When payment intervals coincide, it is common practice to exchange only the net difference between the fixed and floating payments.

Price Quotation The price of a fixed/floating swap is quoted in two parts: a fixed interest rate and an index upon which the floating interest rate is based. The floating rate can be based on an index of short-term market rates (such as a given maturity of LIBOR) plus or minus a given margin, or set to the index "flat"—that is, the floating interest rate index itself with no margin added. The convention in the swap market is to quote the fixed interest rate as an All-In-Cost (AIC), which means that the fixed interest rate is quoted relative to a flat floating-rate index.

The AIC typically is quoted as a spread over U.S. Treasury securities with a maturity corresponding to the term of the swap. For example, a swap dealer might quote a price on a three-year generic swap at an All-In-Cost of "72-76 flat," which means the dealer stands ready to "buy" the swap (that is, enter into the swap as a fixed-rate payer) at 72 basis points over the prevailing three-year interest rate on U.S. Treasuries while receiving floating-rate payments indexed to a specified maturity of LIBOR with no margin, and "sell" (receive fixed and pay floating) if the other party to the swap agrees to pay 76 basis points over Treasury securities.

Bid-asked spreads in the swap market vary greatly depending on the type of agreement. The spread can be as low as 3 to 4 basis points for a two- or three-year generic swap, while spreads for nonstandard, custom-tailored swaps tend to be much higher.

The Generic Swap As an illustration of the mechanics of a simple interest rate swap, consider the example of a generic swap. Fixed interest payments on a generic swap typically are based on a 30/360 day-count convention, meaning that they are calculated assuming each month has 30 days and the quoted interest rate is based on a 360-day year. Given an All-In-Cost of the swap, the semiannual fixed-rate payment would be

$$(N)(AIC)(180/360),$$

where N denotes the notional principal amount of the agreement.

Floating-rate payments are based on an actual/360-day count, meaning that interest payments are calculated using the actual number of days elapsed since the previous payment date, based on a 360-day year. Let d_t denote the number of days since the last settlement date. Then, the floating-rate payment is determined by the formula

$$(N)(LIBOR)(d_t/360).$$

To illustrate, suppose a dealer quotes an All-In-Cost for a generic swap at 10 percent against six-month LIBOR flat. If the notional principal amount of the swap is $1 million, then the semiannual fixed payment would be

$$\$50{,}000 = (\$1{,}000{,}000)(0.10)(180/360).$$

Suppose that the six-month period from the effective date of the swap to the first payment date (sometimes also termed a settlement date) comprises 181 days and that the corresponding LIBOR was 8 percent on the swap's effective date. Then, the first floating-rate payment would be

$$\$40{,}222.22 = (\$1{,}000{,}000)(0.08)(181/360).$$

Often a swap agreement will call for only the net amount of the promised payments to be exchanged. In this example, the fixed-rate payer would pay the floating-rate payer a net amount of

$$\$9,777.78 = \$50,000.00 - \$40,222.22.$$

A payment frequency "mismatch" occurs when the floating-rate payment frequency does not match the scheduled frequency of the fixed-rate payment. Mismatches typically arise in the case of swaps that base floating-rate payments on maturities shorter than the six-month payment frequency common for fixed-rate payments. Macfarlane, Ross, and Showers (1990) discuss swap mismatches in some detail.

Day-Count Conventions A wide variety of day-count conventions are used in the swap market. Fixed payments can be quoted either on an actual/365 (bond equivalent) basis or on an actual/360 basis. Floating-rate payments indexed to private-sector interest rates typically follow an actual/360 day-count convention commonly used in the money market. Floating-rate payments tied to Treasury bill rates are calculated on an actual/365 basis, however.

Nongeneric Swaps An interest rate swap that specifies an exchange of payments based on the difference between two different variable rates is known as a "basis swap." For example, a basis swap might specify the exchange of payments based on the difference between LIBOR and the prime rate. Other interest rate swaps include the forward swap, in which the effective date of the swap is deferred; the swaption, which is an option on an interest rate swap; and puttable and callable swaps, in which one party has the right to cancel the swap at certain times. This list is far from exhaustive—many other types of interest rate swaps are currently traded, and the number grows with each year. Abken (1991b) describes a variety of different swap agreements.

Swap Valuation Interest rate swaps can be viewed as implicit mutual lending arrangements. A party to an interest rate swap implicitly holds a long position in one type of interest-bearing security and a short position in another. Swap valuation techniques utilize this fact to reduce the problem of pricing an interest rate swap to a straightforward problem of pricing two underlying hypothetical securities having a redemption or face value equal to the notional principal amount of the swap. The method used to value a fixed/floating swap is outlined below.

Partitioning a Swap A fixed/floating swap can be partitioned into (1) a bond paying a fixed coupon and (2) a variable-rate note with payments tied to the variable-rate index. Let $S(0, T)$ denote the value of a T-period swap on its initial

settlement date (date 0), $B(0, T)$ the value of a hypothetical T-period fixed-rate bond paying a coupon equal to the fixed-rate payments specified by the agreement, and $V(0, T)$ the value of a variable-rate note maturing at date T. Assuming that the face or redemption value of both hypothetical securities is equal to the notional principal amount of the swap, the value of the swap to a fixed-rate payer can be expressed as

$$S(0,T) = V(0,T) - B(0,T).$$

Pricing the Variable-Rate Note A variable-rate note whose payments are indexed to market interest rates is valued at par upon issuance and just after each interest payment is made. Thus, assuming that payment dates coincide with interest rate reset dates, the value of the hypothetical variable-rate note $V(0, T)$ will just equal the notional principal amount of the swap on every reset date. On any other date the value of a variable-rate note—exclusive of accrued interest—is just the present value of the next known interest payment plus the present value of the face value of the note, the latter amount representing the value of all remaining payments on the note as of the next settlement date.

Pricing the Fixed-Rate Note The hypothetical fixed-rate note $B(0, T)$ can be priced using standard bond valuation techniques. The convention in swap markets is to quote the AIC as a semiannual bond-equivalent rate. The formula for valuing a bond paying semiannual fixed coupon payments is

$$B(0, T) = \sum_{t=0}^{2T} [(C/2)/(1 + y/2)^t] + [N/(1 + y)^T],$$

where C is the annual coupon payment, T the number of years to maturity, N the principal or face value, and y the yield-to-maturity of the bond.

By definition, the All-In-Cost of a fixed/floating swap is the yield to maturity that just makes the value of the hypothetical fixed-rate bond equal to the notional principal amount of the swap. The annual coupon payment for this hypothetical bond is determined by the AIC and the notional principal amount of the agreement:

$$C = (AIC/100)(N),$$

where AIC is expressed as a percentage rate. It is easy to see that the value of the hypothetical bond implicit in this fixed/floating swap will be par (the notional principal amount of the swap) when

$$y = AIC/100.$$

Nonpar Swaps In most cases swaps are priced so that the initial value of the agreement is zero to both counterparties; that is, so that the value of both hypothetical component securities is just equal to the notional principal amount of

the swap. Occasionally, however, a swap may be priced such that one party owes money to the other at initial settlement, resulting in a "nonpar" swap. Nonpar swaps are used to offset existing positions in swaps entered into in previous periods where interest rates have changed since the original swap was negotiated, or in cases where a given cash flow needs to be matched exactly (Dattatreya 1992). Valuation methods for nonpar swaps are somewhat more involved than the simple case discussed above. Interested readers can find more comprehensive discussions of swap valuation in Beckstrom (1990), Iben (1990), and Macfarlane, Ross, and Showers (1990).

The Effect of Changes in Market Interest Rates on Swap Values A change in market interest rates affects the value of a fixed/floating swap in much the same way that it affects the value of a corporate bond with a comparable maturity. To see why, note that a change in market interest rates will have no effect on the value of the hypothetical variable-rate note implicit in a fixed/floating swap on interest rate reset dates. Therefore, on reset dates a change in market interest rates will affect the value of the swap only through its effect on the value of the hypothetical fixed-rate bond. Since an increase in interest rates lowers the value of the bond, it increases the value of the swap position for a fixed-rate payer to the same degree it would increase the value of a short position in a fixed-rate bond.

Between interest rate reset dates the amount of the next payment due on the variable-rate note is predetermined. Thus, a change in market interest rates affects the values of both the hypothetical variable-rate note and the hypothetical fixed-rate bond. The change in the value of the variable-rate note partially offsets the change in the value of the fixed-rate note in this case. As a general rule the price behavior of a fixed/floating interest rate swap will approximate the price behavior of a fixed-rate note with a maturity equal to the term of the swap less the maturity of the variable interest rate. For example, a two-year generic swap indexed to six-month LIBOR will approximate the behavior of a fixed-rate bond with a term to maturity of between 18 and 24 months, depending on the amount of time since the last interest rate reset date (Burghardt et al. 1991, p. 86).

The value of a fixed/floating swap generally changes over time when the term structure of interest rates is upward-sloping. Only when the term structure is flat and market interest rates remain unchanged will the value of an interest rate swap remain unchanged over the life of the agreement (Smith, Smithson, and Wakeman 1988).

INTEREST RATE CAPS

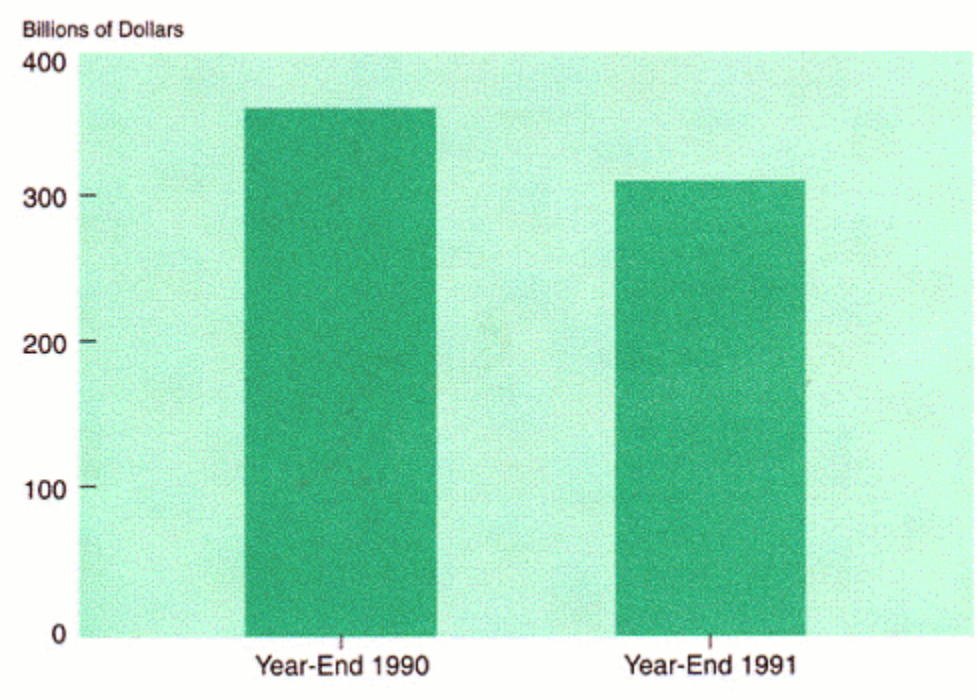
The buyer of an interest rate cap pays the seller a premium in return for the right to receive the difference in the interest cost on some notional principal amount any time a specified index of market interest rates rises above a stipulated "cap

rate." The buyer bears no obligation or liability if interest rates fall below the cap rate, however. Thus, a cap resembles an option in that it represents a right rather than an obligation to the buyer.

Caps evolved from interest rate guarantees that fixed a maximum level of interest payable on floating-rate loans. The advent of trading in over-the-counter interest rate caps dates back to 1985, when banks began to strip such guarantees from floating-rate notes to sell to the market (Kahle 1992). The leveraged buyout boom of the 1980s spurred the evolution of the market for interest rate caps. Firms engaged in leveraged buyouts typically took on large quantities of short-term debt, which made them vulnerable to financial distress in the event of a rise in interest rates. As a result, lenders began requiring such borrowers to buy interest-rate caps to reduce the risk of financial distress (Burghardt et al. 1991). More recently, trading activity in interest rate caps has declined as the number of new leveraged buyouts has fallen. Figure 3 shows that the total notional principal amount of caps, floors, and collars outstanding at the end of 1991 actually fell to $311 billion from $360 billion at the end of 1990 (floors and collars are discussed below).

FIGURE 3

U.S. Dollar Caps, Collars, and Floors



Source: *Market Survey Highlights, Year End 1991,* International Swap Dealers Association, Inc.

Market Conventions An interest rate cap is characterized by:

- a notional principal amount upon which interest payments are based;
- an interest rate index, typically some specified maturity of LIBOR;
- a cap rate, which is equivalent to a strike or exercise price on an option; and
- the period of the agreement, including payment dates and interest rate reset dates.

Payment schedules for interest rate caps follow conventions in the interest rate swap market. Payment amounts are determined by the value of the index rate on a series of interest rate reset dates. Intervals between interest rate reset dates and scheduled payment dates typically coincide with the term of the interest rate index. Thus, interest rate reset dates for a cap indexed to six-month LIBOR would occur every six months with payments due six months later. Cap buyers typically schedule interest rate reset and payment intervals to coincide with interest payments on outstanding variable-rate debt. Interest rate caps cover periods ranging from one to ten years with interest rate reset and payment dates most commonly set either three or six months apart.

If the specified market index is above the cap rate, the seller pays the buyer the difference in interest cost on the next payment date. The amount of the payment is determined by the formula

$$(N)\ \max(0,\ r - r_c)(d_t/360),$$

where N is the notional principal amount of the agreement, r_c is the cap rate (expressed as a decimal), and d_t is the number of days from the interest rate reset date to the payment date. Interest rates quoted in cap agreements follow money market day-count conventions, so that payment calculations assume a 360-day year.

Figure 4 depicts the payoff to the buyer of a one-period interest rate cap. If the index rate is above the cap rate, the buyer receives a payment of $(N)(\ r - r_c\ )(d_t/360)$, which is equivalent to the payoff from buying an FRA.[2] Otherwise, the buyer receives no payment and loses the premium paid for the cap. Thus, a cap effectively gives its buyer the right, but not the obligation, to buy an FRA with a forward rate equal to the cap rate. Such an agreement is known as a call option. A one-period cap can be viewed as a European call option on an FRA with a strike price equal to the cap rate r_c.[3] More generally, multi-period

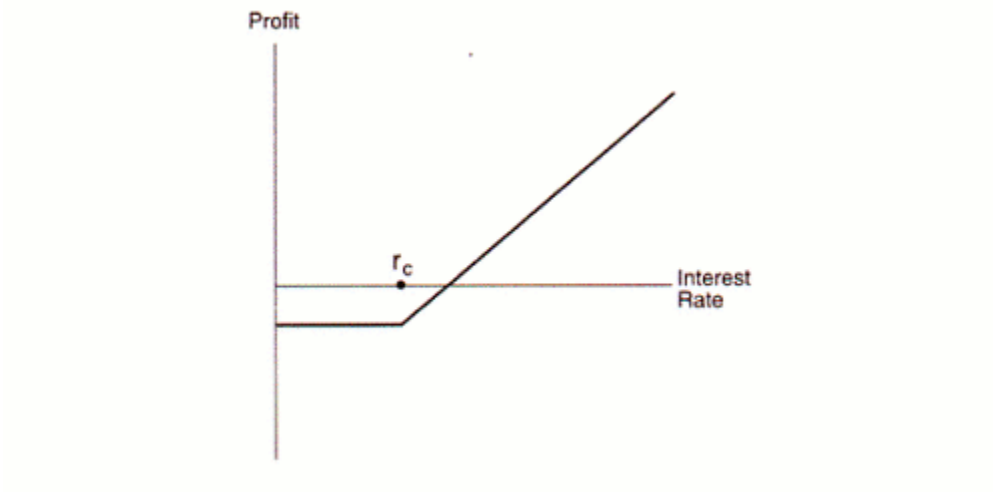
[2] One difference between the payoff to an FRA and the payoff to an in-the-money cap is that an FRA pays the present value of the change in interest payable on the notional principal at settlement (which corresponds to the reset date of a cap), while payments on caps are deferred. The value of the payment has the same present value in both cases, however, so that the comparison between the payoff to a cap and a call option on an FRA remains accurate.

[3] A European option can be exercised only on its expiration date. Similarly, a cap buyer can only "exercise" his option if the index rate is above the cap rate on the interest rate reset date, so that the interest rate reset date corresponds to the expiration date on a European-style option.

FIGURE 4

The Payoff to Buying a

One-Period Interest Rate Cap



caps, which specify a series of future interest rate reset and payment dates, can be viewed as a bundle of European call options on a sequence of FRAs.

Example of an Interest Rate Cap Consider the example of a one-year interest rate cap that specifies a notional principal amount of $1 million and a six-month LIBOR cap rate of 5 percent. Assume the agreement covers a period starting January 15 through the following January 15 with the interest rate to be reset on July 15. The first period of a cap agreement typically is excluded from the agreement, so the cap buyer in this example will be entitled to a payment only if the six-month LIBOR exceeds 5 percent on the July 15 interest rate reset date. Suppose that six-month LIBOR is 5.5 percent on July 15. Then, on the following January 15 (184 days after the July 15 reset date) the seller will owe the buyer

$$\$2{,}555.56 = (\$1{,}000{,}000)(0.055 - 0.050)(184/360).$$

Comparison of Caps and Futures Options A one-period cap can be compared to a put option on a Eurodollar futures contract. To see why, note that the payoff at expiration to a put option on Eurodollar futures is

$$(N)\ \max(0,\ K - F)(90/360),$$

where N is the notional principal amount of the agreement ($1 million for a Eurodollar futures option), K is the strike price and F is the price of the underlying futures contract. The price index used for Eurodollar futures can be written

as $F = 100 - r$, where r is the three-month LIBOR implied by the futures price. Now, write $K = 100 - r_k$, where r_k is the futures interest rate implied by the strike price K. Then, the payoff at expiration to a Eurodollar futures option can be expressed as

$$(N)\ \max[0, 100 - r_k - (100 - r)](90/360) = (N)\ \max(0, r - r_k)(90/360).$$

where, as before, N is the notional principal amount of the agreement, r_c is the cap rate, r_f is the floor rate, and d_t is the term of the index in days. Figure 7 illustrates the payoff to buying a one-period zero-cost interest rate collar. If the index interest rate r is less than the floor rate r_f on the interest rate reset date, the floor is in-the-money and the collar buyer (who has sold a floor) must pay the collar counterparty an amount equal to $(N)(r_f - r)(d_t/360)$. When r is greater than r_f but less than the cap rate r_c, both the floor and the cap are out-of-the-money and no payments are exchanged. Finally, when the index is above the cap rate the cap is in-the-money and the buyer receives $(N)(r - r_c)(d_t/360)$.

FIGURE 7

The Payoff to Buying a

One-Period, Zero-Cost Collar

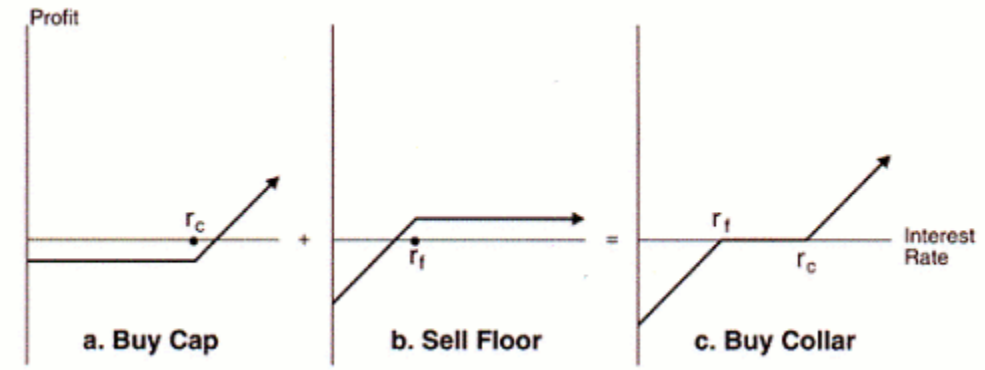


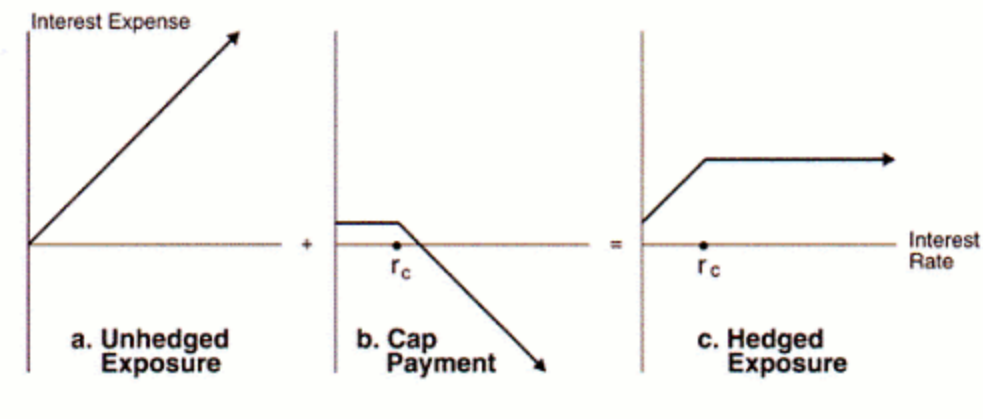
Figure 8 illustrates a special case of a zero-cost collar that results from the simultaneous purchase of a one-period cap and sale of a one-period floor when the cap and floor rates are equal. In this case the combined transaction replicates the payoff of an FRA with a forward interest rate equal to the cap/floor rate. This result is a consequence of a property of option prices known as put-call parity.

More generally, the purchase of a cap and sale of a floor with the same notional principle, index rate, strike price, and reset dates produces the same payout stream as an interest rate swap with an All-In-Cost equal to the cap or

FIGURE 5

The Effect of Buying a Cap

on Interest Expense



if the index interest rate rises above the floor rate, so the most a buyer can lose is the premium paid to the seller at the outset of the agreement.

The payment received by the buyer of an interest rate floor is determined by the formula

$$(N)\ \max(0,\ r_f - r)(d_t/360),$$

where N is the notional principal amount of the agreement, r_f is the floor rate or strike price, and d_t is the number of days from the last interest rate reset date to the payment date. Figure 6 depicts the payoff to a one-period floor as a function of the value of the underlying index rate. If the index rate is below the floor rate on the interest rate reset date the buyer receives a payment of $(N)(r_f - r)(d_t/360)$, which is equivalent to the payoff from selling an FRA at a forward rate of r_f. On the other hand, if the index rate is above the floor rate the buyer receives no payment and loses the premium paid to the seller. Thus, a floor effectively gives the buyer the right, but not the obligation, to sell an FRA, which makes it equivalent to a European put option on an FRA. More generally, a multi-period floor can be viewed as a bundle of European-style put options on a sequence of FRAs maturing on a succession of future maturity dates.

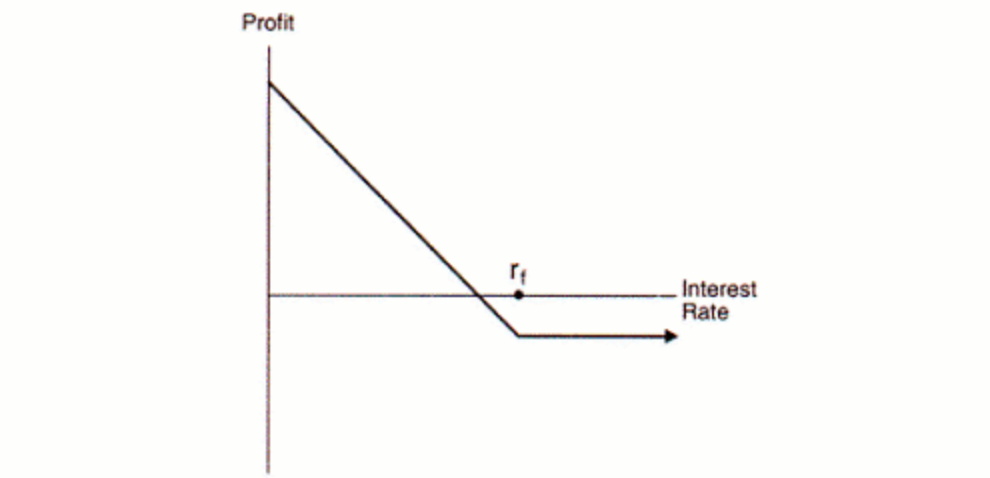
Comparison of Floors and Futures Options Purchasing a one-period interest rate floor yields a payoff closely resembling that of a long Eurodollar futures call option. The payoff to a call option on a Eurodollar futures contract is

$$(N)\ \max(0,\ F - K)(90/360),$$

FIGURE 6

The Payoff to Buying a

One-Period Interest Rate Floor



where $F = 100 - r$ is the index price of the underlying futures contract and K is the strike price. As before, write $K = 100 - r_k$. Then, the payoff to a Eurodollar futures call option can be expressed in terms of the underlying interest rate as

$$(N) \max(0, r_k - r)(90/360),$$

which is the same as the payoff to a one-period interest rate floor indexed to 90-day LIBOR with a floor rate equal to r_k. The one noteworthy difference between the two instruments is that a Eurodollar futures option can be exercised at any time, while a floor resembles a European option that can only be exercised on its expiration date. Like caps, interest rate floors settle in arrears, whereas a futures option settles on its expiration date.

INTEREST RATE COLLARS

The buyer of an interest rate collar purchases an interest rate cap while selling a floor indexed to the same interest rate. Borrowers with variable-rate loans buy collars to limit effective borrowing rates to a range of interest rates between some maximum, determined by the cap rate, and a minimum, which is fixed by the floor strike price; hence, the term "collar." Although buying a collar limits a borrower's ability to benefit from a significant decline in market interest rates, it has the advantage of being less expensive than buying a cap alone because the borrower earns premium income from the sale of the floor that offsets the cost

of the cap. A zero-cost collar results when the premium earned by selling a floor exactly offsets the cap premium.

The amount of the payment due to or owed by a buyer of an interest rate collar is determined by the expression

$$(N)[\max(0, r - r_c) - \max(0, r_f - r)](d_t/360),$$

where, as before, N is the notional principal amount of the agreement, r_c is the cap rate, r_f is the floor rate, and d_t is the term of the index in days. Figure 7 illustrates the payoff to buying a one-period zero-cost interest rate collar. If the index interest rate r is less than the floor rate r_f on the interest rate reset date, the floor is in-the-money and the collar buyer (who has sold a floor) must pay the collar counterparty an amount equal to $(N)(r_f - r)(d_t/360)$. When r is greater than r_f but less than the cap rate r_c, both the floor and the cap are out-of-the-money and no payments are exchanged. Finally, when the index is above the cap rate the cap is in-the-money and the buyer receives $(N)(r - r_c)(d_t/360)$.

FIGURE 7

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One-Period, Zero-Cost Collar

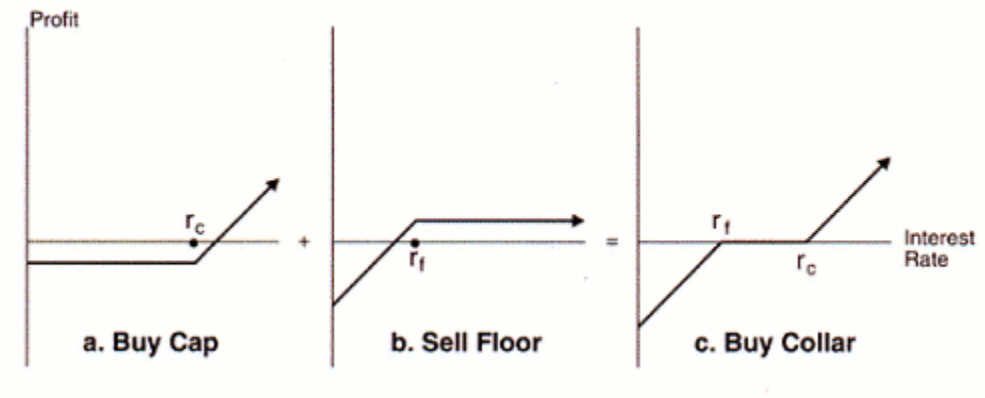
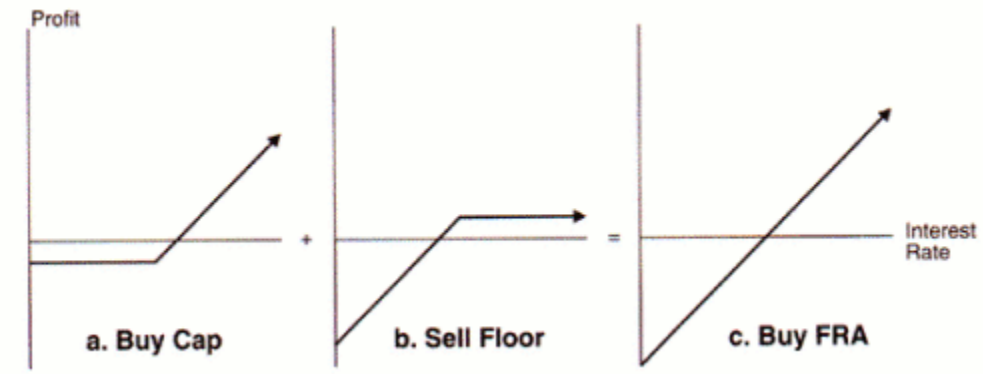


Figure 8 illustrates a special case of a zero-cost collar that results from the simultaneous purchase of a one-period cap and sale of a one-period floor when the cap and floor rates are equal. In this case the combined transaction replicates the payoff of an FRA with a forward interest rate equal to the cap/floor rate. This result is a consequence of a property of option prices known as put-call parity.

More generally, the purchase of a cap and sale of a floor with the same notional principle, index rate, strike price, and reset dates produces the same payout stream as an interest rate swap with an All-In-Cost equal to the cap or

FIGURE 8

Put-Call Parity



floor rate. Since caps and floors can be viewed as a sequence of European call and put options on FRAs, buying a cap and selling a floor with the same strike price and interest rate reset and payment dates effectively creates a sequence of FRAs, all with the same forward rate. But note that an interest rate swap can be viewed as a sequence of FRAs, each with a forward rate equal to the All-In-Cost of the swap. Therefore, put-call parity implies that buying a cap and selling a floor with the same contract specifications results in the same payment stream that would be obtained by buying an interest rate swap.

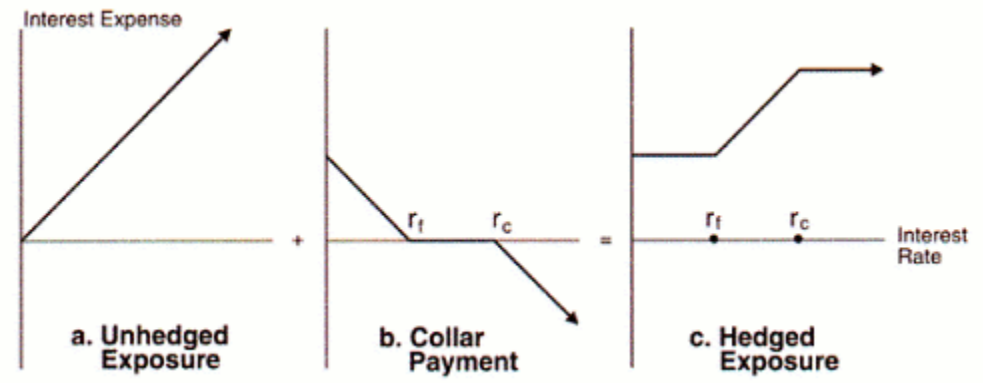
In recent years dealers in the OTC derivatives market have shown a great deal of ingenuity in devising new hybrid instruments yielding an almost endless variety of payout patterns. Interested readers can find descriptions of other types of derivatives in Abken (1989), Burghardt et al. (1991), Smith and Smithson (1990), and Smith, Smithson, and Wilford (1989).

Hedging Uses of Interest Rate Collars Figure 9 illustrates the effect that buying a one-period, zero-cost collar has on the exposure to changes in market interest rates faced by a firm with outstanding variable-rate debt. The first panel depicts the firm's inherent or unhedged interest exposure, while the second panel illustrates the effect that buying a collar has on interest expense. Finally, the third panel combines the borrower's inherent exposure with the payoff to buying a collar to display the effect of a change in market interest rates on a hedged borrower's interest expense. Note that changes in market interest rates can only affect the hedged borrower's interest expense when the index rate varies between the floor and cap rates. Outside this range, the borrower's interest expense is completely hedged.

FIGURE 9

The Effect of Buying an Interest Rate Collar

on Interest Expense



RISK AND REGULATION IN THE OVER-THE-COUNTER DERIVATIVES MARKET

Regulatory Concerns The OTC derivatives market is often characterized as unregulated because no federal regulatory agency oversees trading activity in this market, as the Commodity Futures Trading Commission (CFTC) does with futures markets or the Securities and Exchange Commission (SEC) does with securities markets.[4] Yet it would be misleading to characterize the OTC derivatives market as completely unregulated. Many of the largest derivatives dealers are affiliates of commercial banks, which rank among the most heavily regulated of all firms. Bank regulatory agencies routinely conduct on-site examinations to review procedures in place for controlling risks at the institutions they supervise. Additionally, regulations imposed by the federal banking agencies include minimum capital requirements designed to take account of credit risk exposure arising in connection with derivative instruments.[5] While not subject to the comprehensive regulatory oversight applied to commercial banks, investment banks dealing in OTC derivatives are subject to SEC scrutiny. And the International Swap Dealers Association (ISDA)—an industry association organized by the major OTC derivatives dealers—sets standards for market practices and addresses the legal and public policy issues affecting the market.

[4] See Abken (1991a) for a description of these other markets.

[5] Rogers (1990) discusses capital requirements for OTC derivatives.

Nonetheless, the rapid growth and sheer size of the OTC derivatives market has sparked debate over the risks posed by the growth of trading in derivative instruments and the appropriate scope of market regulation.[6] When all types of derivative agreements are taken into account, including currency swaps, caps, floors, collars, and swaptions, the total notional principal amount of outstanding agreements exceeded $4 trillion at the end of 1991, with derivatives dealers acting as middlemen to most transactions. Much of the trading activity in this market takes place between a relatively small number of large dealers, resulting in an interdependent web of obligations among those dealers.[7] Unlike exchange-traded derivatives such as futures contracts and futures options, where the exchange clearinghouses guarantee contract performance through a system of margin requirements, daily settlement of gains and losses, and the backing of the capital of clearing member firms, OTC derivative instruments are bilateral arrangements that carry no independent third-party guarantee. As a result, counterparties to OTC instruments face the risk of default, known as counterparty credit risk. Moreover, the absence of contract standardization means that OTC derivatives tend to be less liquid than exchange-traded derivatives, which can make it difficult to execute transactions in periods of extreme price volatility or when a counterparty's credit standing is questioned.

A recent joint study by the three federal banking agencies examined the risks posed by the growth of trading in OTC derivatives (Board of Governors of the Federal Reserve System, Federal Deposit Insurance Corporation, and Office of the Comptroller of the Currency 1993). The study found that risks associated with OTC derivatives differed little from the risks traditionally borne by financial intermediaries. Although it did identify a number of concerns, the study concluded that trading in derivative instruments has not contributed to the overall fragility of the financial system and does not pose undue risks for organizations active in this market. To the contrary, it cited at least one instance—namely, the period of exchange rate turbulence in European currencies in September of 1992—where it concluded that foreign currency markets were not likely to have performed as well as they did during the crisis without the existence of foreign currency derivatives that enabled financial institutions to manage their currency positions.

The joint study identified six different types of risks in connection with derivative instruments: credit risk, market risk, liquidity risk, settlement risk, operating risk, and aggregation risk. As noted earlier, much of the concern over the growth of the market has centered around the issue of counterparty credit risk because of the sheer size of the market and the size of credit exposures

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[6] For example, see Corrigan (1992), Bank for International Settlements (1992), and Hansell and Muehring (1992).

[7] Data in ISDA's *Market Survey Highlights,* Second Half 1991, indicates that 47 percent of all new interest rate swaps arranged in 1991 were between ISDA member organizations.

borne by dealers. Because derivative instruments tie together so many different markets around the world, regulators have expressed concerns that aggregation, or interconnection risk, might make it difficult to contain a financial crisis to keep it from spreading to other markets. The remainder of this chapter discusses some of the risks associated with OTC derivatives and the legal, regulatory, and market arrangements that have developed to deal with such risks.

Counterparty Credit Risk

Measuring the Credit Risk Exposure of an FRA The credit risk exposure associated with an FRA, or any other derivative instrument for that matter, differs from that of a debt instrument because an FRA is not a funding transaction and therefore involves no exchange of principal. At its inception the value of an FRA is zero to both parties, so there is no initial credit risk. Potential credit risk is bilateral: a party to an FRA is exposed to credit risk when the value of the agreement becomes positive to him or her, and the value of an FRA can change so as to gain value to either party. Unlike a loan agreement, where financial distress on the part of a borrower always exposes the lender to default risk, financial distress on the part of an FRA counterparty does not necessarily expose the other counterparty to the risk of default. A financially distressed firm has no incentive to default on an agreement that has positive value to it—and even if such a counterparty were to default, the nondefaulting party would suffer no loss.

Since an FRA involves no exchange of principal, potential credit risk exposure is a small fraction of the notional principal amount of the agreement. Credit risk exposure is determined by the value of the FRA, which corresponds to the cost of replacing the FRA. To illustrate, recall the earlier example of a 1x4 FRA with a notional principal of $1 million and a forward rate of 5 percent. If market interest rates rise by 50 basis points immediately after the agreement is negotiated, the value of the FRA to the buyer is just the current present value of $1,250 (50 basis points x $25 per basis point), or

$$\$1{,}229.51 = \$1{,}250/[1 + 0.050(120/360)].$$

This calculation determines the value of the agreement exactly 30 days before its scheduled settlement, or maturity date. The credit risk exposure borne by the FRA buyer in this example is just over 1/10 of 1 percent of the notional principal amount of the agreement.

Measuring the Credit Risk Exposure of an Interest Rate Swap A swap counterparty's credit risk exposure is determined by the cost of replacing the agreement in the event of a default. The cost of obtaining a replacement swap is determined by the difference between the All-In-Cost of the old swap and the AIC on a replacement swap. As an illustration, consider the case of a fixed rate payer in a

swap with one year left to maturity and a 7 percent AIC. If the floating-rate payer defaults when the prevailing market rate on a one-year replacement swap is 8 percent, the nondefaulting party will be required to pay an extra 1 percent per year on the notional principal to replace the swap. The replacement value of the swap is just the net present value of the difference in interest payments.

In discussing swap valuation methods it was useful to view a swap as an implicit mutual lending arrangement in which the counterparties exchanged loans indexed to two different interest rates. In looking at credit risk exposure, however, it can be useful to view a swap as a bundle of FRAs, all with forward rates equal to the All-In-Cost of the swap. Thus, the swap in the above example can be viewed as a combination of a 0x6 FRA and a 6x12 FRA, each with a forward rate of 7 percent. The replacement cost of the swap is just equal to the value of the two component FRAs when the underlying index rate is 8 percent.

As with FRAs, the potential credit risk exposure of an interest rate swap typically is a small fraction of the notional principal amount of the agreement. By one estimate, the expected lifetime credit exposure associated with an interest rate swap varies from 0.002 percent of the notional principal for a swap with a one-year maturity to 4.5 percent for a swap with a ten-year maturity (Simons 1989).

Credit Risk Exposure of Caps, Floors, and Collars Sellers of caps and floors face no credit risk, since neither type of agreement requires the buyer to make any payments other than the initial premium. But cap and floor buyers face the risk of nonperformance on the part of the seller any time a cap or floor goes "in-the-money"—that is, any time the seller is required to make payments to the buyer. Since a collar involves a short position in a floor and a long position in a cap, it can expose both the buyer and seller to counterparty credit risk.

The credit risk exposure faced by the buyer of an interest rate cap can be compared to the risk exposure of a fixed-rate payer in an interest rate swap. In both cases, the buyers face the risk that the seller will default when interest rates rise. Similarly, the buyer of an interest rate floor faces a credit risk exposure analogous to that of a floating-rate payer, or seller, of an interest rate swap. The total credit risk exposure in each case is determined by the cost of buying a replacement cap or floor.

Netting Arrangements When dealers first began acting as intermediaries in swap agreements the risk associated with each swap was accounted for separately. As the market grew, swap dealers found themselves parties to multiple agreements with the same counterparty. Concern over their growing aggregate exposure led many dealers to adopt "master" agreements that treated all their transactions with a given counterparty as supplements to a single consolidated agreement. These master agreements gave swap counterparties the right to terminate all supplemental swap agreements in the event of default on any one of the swaps. The advent

of the master agreement represented an attempt by swap dealers to limit the credit risk exposure with any single counterparty to the net value of all swaps with that counterparty. Today virtually all OTC derivatives utilize a standardized master agreement designed by the International Swap Dealers Association (Gooch and Pergam 1990).

The Status of OTC Derivatives Under Bankruptcy Law Before the enactment of recent amendments to the Bankruptcy Code, there was some question as to whether master swap agreement netting provisions would be legally enforceable in the event of bankruptcy. The U.S. Bankruptcy Code grants a firm in bankruptcy proceedings an "automatic stay" from the claims of its creditors. The automatic stay allows a bankrupt firm to postpone scheduled debt payments and overrides most other contractual obligations pending the resolution of all claims against the firm. Thus, although virtually all lending agreements give creditors the right to demand accelerated repayment of a loan in the event of a default on a scheduled payment, default inevitably delays repayment in practice. Often, creditors of the bankrupt firm receive only a fraction of the amounts owed them even if the firm ultimately emerges from bankruptcy proceedings as a reorganized entity. Swap market participants faced the risk that the Bankruptcy Courts might enforce the automatic stay against swap agreements, making the netting provisions of the ISDA master swap agreement unenforceable. Nondefaulting counterparties would then face the risk that a bankruptcy trustee might selectively default only on swaps having a negative value to a bankrupt counterparty, a practice known as "cherry picking."

Public Law 101-311, enacted on June 25, 1990, amended the Bankruptcy Code to exempt swap agreements executed under a single master agreement such as the ISDA master agreement from the automatic stay normally applicable to creditors of a bankrupt firm. The amendments were enacted to make the netting provisions of the ISDA master swap agreement enforceable in the event of bankruptcy. The Bankruptcy Code amendments also authorize nondefaulting swap counterparties to utilize any collateral posted in connection with a swap agreement to offset the net amount owed by a bankrupt counterparty (Rogers 1990). In this respect, the law treats OTC derivatives analogously to exchange-traded futures contracts.[8] These provisions greatly mitigate the potential loss faced by swap counterparties when the parties involved have multiple agreements with one another.

The Status of Swap Agreements Under Banking Law Commercial banks and thrift institutions are not subject to the provisions of the Bankruptcy Code. Instead, bank failure resolution is governed by federal and state banking laws, which

[8] Williams (1986) stresses the importance of the exemption of futures margin requirements from the automatic stay as a prime reason for the existence of futures markets. Williams' theory is discussed in Chapter 14.

gives the Federal Deposit Insurance Corporation (FDIC) and the Resolution Trust Corporation (RTC) (in the case of certain savings and loan institutions) considerable discretion in dealing with failing federally insured depository institutions. The FDIC and RTC may act in the capacity of either a conservator or a receiver. An institution placed in conservatorship is not declared legally insolvent. It continues its normal business operations under the close scrutiny of federal regulators pending resolution of its financial difficulties. Institutions in conservatorship are either returned to private sector control, through a sale or merger, or they are eventually declared insolvent. When a federally insured depository institution is declared legally insolvent either the FDIC or RTC becomes the receiver for the institution. Regulators may resolve bank failures either through a "purchase and assumption" transaction in which the failed institution is taken over by another bank or thrift or, less often, through liquidation.[9]

The Financial Institutions Reform, Recovery, and Enforcement Act of 1989 (FIRREA) contains provisions similar to the netting provisions of the Bankruptcy Code requiring the receiver of a failed bank or conservator of a failing bank to treat all supplemental swap agreements executed under a single master agreement as a single contract. In the event of a default or liquidation of a bank or thrift, the institution's counterparties maintain the right to accelerate repayment of all swap agreements made under a single master agreement. Counterparties do not have an automatic right to terminate existing swap agreements when an institution is placed into conservatorship, however, because an institution in conservatorship has not legally failed (although they do retain the right to demand accelerated repayment in the event of a default or breach of another covenant). FIRREA gives bank regulators the express right to transfer all derivative instruments covered by a single master agreement, along with other bank assets, to another institution, either when the institution is in conservatorship or in the case of a purchase and assumption transaction. But in this latter case the master agreement and all its supplements must be treated as a single agreement and transferred together with all applicable collateral. Thus, the law discourages federal regulators from cherry picking among individual OTC agreements that are part of a larger master agreement.[10] Nondefaulting counterparties still face the risk that their agreements might be assigned to a counterparty with a relatively weak credit standing, however.

Although recent legislation has reduced the legal risks faced by domestic counterparties, derivatives dealers with exposures to counterparties outside of the United States still face risks arising from the uncertain legal status of netting arrangements under foreign laws. At present, ISDA is working with authorities

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[9] Dotsey and Kuprianov (1990) describe bank failure resolution policies in more detail.

[10] See Gooch and Pergam (1990) and Rogers (1990) for more details on banking law and netting arrangements.

in other countries to enact bankruptcy legislation resembling the recent Bankruptcy Code amendments enacted in the United States. Until such legislation is enacted, however, internationally active OTC derivatives dealers face considerable legal risk.

Aggregation or Interconnection Risk Aggregation or interconnection risk refers to the risk that a disruption in one market, caused by the default of a major institution or some other event, might cause widespread difficulties throughout the OTC derivatives market or even spread to other financial markets. Market liquidity risk is one source of interconnection risk. OTC derivatives dealers operate in many different markets at once. They must often execute complex, multi-legged transactions to create custom-tailored instruments for their customers while attempting to hedge the resulting exposure to market risk. The successful execution of such operations depends on the ability to complete a number of transactions in different markets almost simultaneously. But experience shows that market liquidity can evaporate quickly, especially in times of financial stress when market participants have reason to question the creditworthiness of potential counterparties. Reduced liquidity can make it difficult for a dealer to hedge its exposure to market price risk or, in the event of a default by a counterparty, make obtaining a replacement swap a costly proposition.

Counterparty credit risk can also be a source of aggregation risk because such a large fraction of trading in OTC derivatives takes place between the dealers themselves. The default of a single major dealer could have a significant effect on the outstanding positions of other major dealers. In addition to potential losses from credit risk exposures, a default by a major derivatives dealer would leave other dealers exposed to considerable price risk. Dealers use derivatives both to hedge their outstanding commitments to other OTC counterparties as well as other asset holdings. These dealers would need to rebalance their portfolios, either by buying or selling new derivative instruments or by quickly selling existing asset holdings. The resulting flurry of activity might conceivably disrupt not only the OTC derivatives market, but other markets as well.

To date, losses incurred by counterparties to OTC derivatives have yet to even approach the magnitude of losses incurred in the course of more traditional lending and investment activities. Worth noting in this regard is that financial markets have survived at least one default by a major derivatives dealer—that of Drexel Burnham Lambert in 1990—without serious disruption, although it has certainly provided headaches for Drexel's former counterparties. Recent legislation recognizing netting arrangements was designed to help contain the consequences of a default by a major derivatives dealer in the United States, although, as noted earlier, other countries have been slow to enact such legislation.

Market Arrangements for Controlling Risks Managing the credit risk associated with a position in an instrument such as an interest rate swap requires credit evaluation skills of the type commonly associated with bank lending. Thus,

as the swaps market evolved into a dealer market where financial intermediaries assumed the role of counterparty to the end users of swap agreements, commercial banks, which have traditionally specialized in credit risk evaluation and have the capital reserves necessary to support credit risk management, came to dominate the market for swaps and other OTC derivatives. Only in cases where a counterparty is deemed a poor credit risk are performance bonds, such as margin requirements of the type employed by futures exchanges, used to substitute for credit evaluation. When performance bonds are used, the agreement often provides for the periodic settlement of changes in the value of a derivative instrument using a process resembling the daily marking-to-market of futures contracts, although settlement generally takes place at less frequent intervals with OTC derivatives (Smith, Smithson, and Wakeman 1986).

The widely publicized financial difficulties of many firms and banks in recent years has made market participants sensitive to the issue of counterparty credit risk. As a result, dealers with less than AA credit ratings have found it increasingly difficult to trade in OTC derivatives. The heavy loan losses and resulting financial difficulty experienced by many commercial banks in recent years has hampered the ability of such institutions to compete in this market. At the same time, a number of investment banks have formed separately capitalized subsidiaries so as to enhance their credit standing and remain competitive in the derivatives market.[11] Thus, market discipline has had the salutary effect of restricting the activities of less creditworthy counterparties.

CONCLUDING COMMENTS

The evolution of the over-the-counter derivatives market has revolutionized the nature of financial intermediation in money markets in a span covering a little more than a decade. Along with the benefits derivatives offer firms in managing cash flows, however, the rapid growth of the market has raised new concerns for regulators and policymakers. Industry spokesmen argue that existing market arrangements are adequate to address such concerns, a view increasingly shared by regulators and policymakers.[12] The development of the ISDA master agreement in recent years, along with recent changes in banking laws and in the U.S. Bankruptcy Code, has gone far to minimize the potential for widespread market disruption that could result from a default on the part of a major dealer in the swaps market. And concerns about counterparty credit risk have led market participants themselves to limit the activities of dealers with less than outstanding credit ratings.

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[11] Federal regulators have yet to grant commercial banks approval to form separately capitalized subsidiaries of the type investment banks have begun to use. See Chew (1992, 1993) and Peltz (1993) for a more detailed discussion of this trend.

[12] For example, see Hansell and Muehring (1992), Phillips (1992), and Shale (1993).

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