

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 Since the money market evolves very rapidly, recent developments may have superseded some of the content of this chapter.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 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

¹Prior 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.

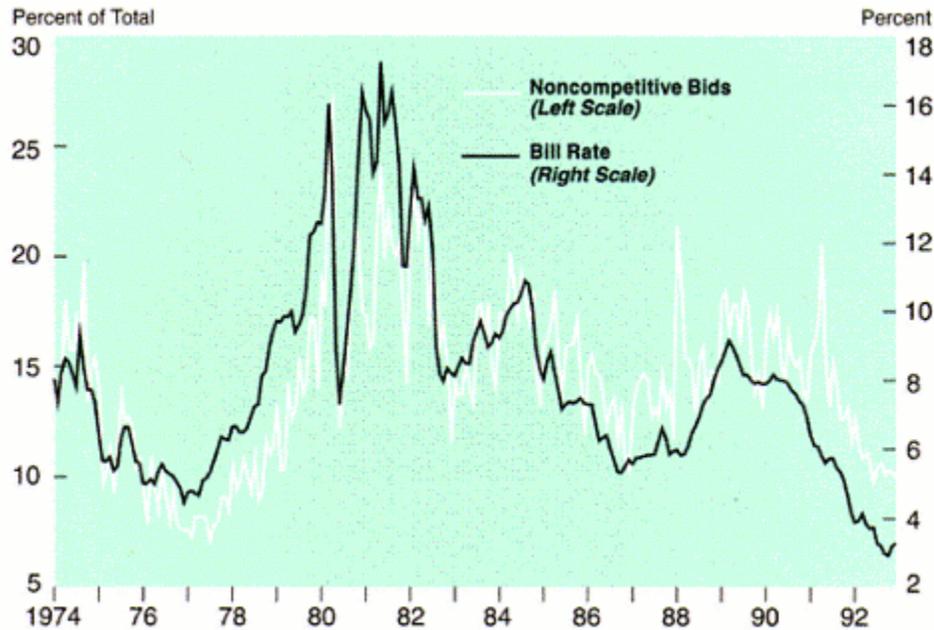
Auctioning New Bills Weekly offerings of three- and six-month Treasury bills are typically announced on Tuesday. The auction is usually conducted on the following Monday, with delivery and payment on the following Thursday. Bids, or tenders, in the weekly auctions must be presented at Federal Reserve 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.

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.

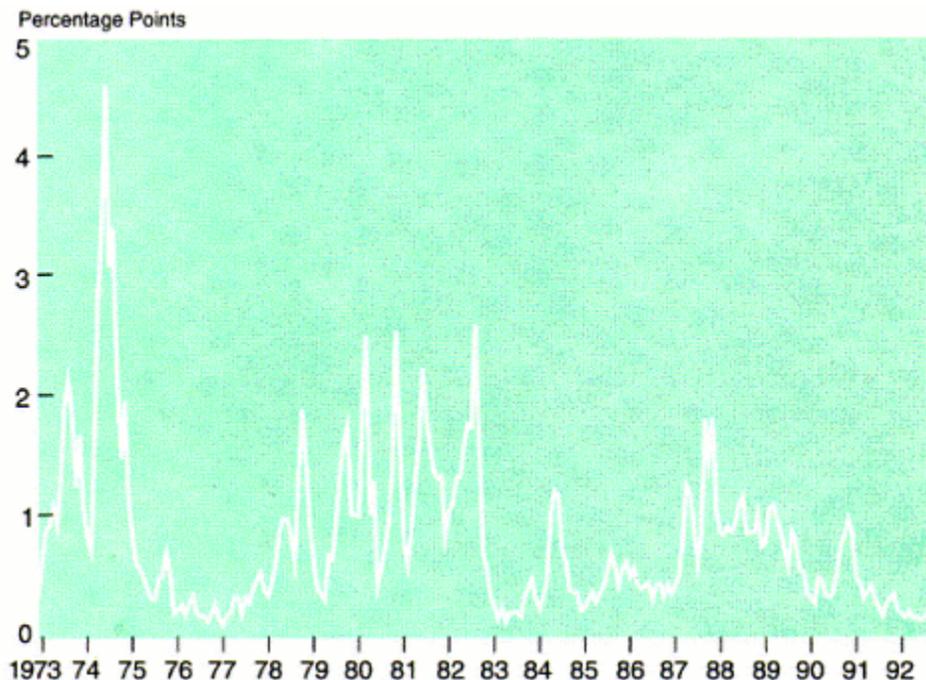
Commercial banks' holding of Treasury bills tends to vary inversely with the demand for business loans. When loan demand is slack, banks increase their holdings of bills and other Treasury securities. Conversely, when loan demand is increasing, banks reduce their holdings of Treasury securities in order 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

$$(100 - 97.912/100) \times (360/182) = 4.13\%$$

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 is⁵

$$(100 - 97.912/97.912) \times (365/182) = 4.28\%$$

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.

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 MARKET⁷

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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