Interest Rate Futures

On a typical day in 1979, futures contracts representing about $7½ billion in three-month Treasury bills changed hands in the International Monetary Market (IMM) of the Chicago Mercantile Exchange in Chicago This market and several other new markets for interest rate futures have very quickly become active trading arenas. For example, at the Chicago Board of Trade (CBT), futures contracts representing $820 million of long-term Treasury bonds were traded on a typical day; also, at the CBT, futures contracts representing $540 million of GNMAs (Government National Mortgage Association securities) changed hands on an average day.

Besides these three well-established interest rate futures contracts, several new financial futures contracts have recently received the approval of the Commodity Futures Trading Commission (CFTC) and have begun trading. Futures contracts for intermediate-term Treasury notes commenced trading in the summer of 1979; in the fall, the Comex (Commodity Exchange, Inc.), which had traded many metals contracts, inaugurated a three-month bill futures contract, and the ACE (Amex Commodities Exchange, Inc., an affiliate of the American Stock Exchange) introduced a bond futures contract; in addition, the New York Stock Exchange is intending to start a financial futures unit.

What accounts for the rapid growth of interest rate futures? Who are the most active participants in these markets? Some businesses such as financial institutions and securities dealers use it to hedge or manage interest rate risk. By and large, however, participants are involved for other reasons and help provide much of the markets' liquidity. A large portion of the activity in these markets is speculative—people and institutions betting on which way interest rates will move and how the interest rate in one month will move relative to another. Others are involved in these interest rate futures markets for tax reasons.

Both the enormous size of these futures markets and the nature of the participants are a matter of concern for the regulatory authorities. The Treasury and the Federal Reserve System have become aware of potential problems for the functioning of markets in Government securities; these problems include the possibility of corners or squeezes on certain Treasury issues and the disruption of orderly cash markets for Treasury securities. In addition, the regulatory authorities have become concerned that the substantial numbers of small investors participating in the markets may not be fully aware of the risks involved.

What is a futures market?

For as long as mankind has traded goods and services, people have made contracts which specify that commodities and money will change hands at some future date, at a price stated in the contract. Such contracts are called "forward" contracts. A forward contract tailored to one's needs offers obvious advantages—one can pick the exact date and the precise commodity desired. On the other hand, there are disadvantages. It may be difficult to locate a buyer or seller with exactly opposite needs. In addition, there is a risk that the other party to the transaction will default.

The authors wish to thank James Kurt Dew, Ronald Hobson, and Anthony Vignola for information and helpful comments The foregoing do not necessarily agree with the views expressed herein, nor do they bear responsibility for any errors

A *futures* contract is a standardized forward contract that is traded on an exchange. Usually the type and grade of commodity is specified as well as the date for delivery. Once a bargain is struck, the clearinghouse of the futures exchange itself becomes the opposite party to every transaction Thus, it is the soundness of the exchange's clearinghouse rather than the creditworthiness of the original buyer (or seller) that is of concern to the seller (or buyer) on the other side of the transaction To ensure its viability, futures exchanges and their clearinghouses set up rules and regulations. These include the requirements that a clearing member firm and its customers put up "margin", that the contracts be marked-to-market daily, and that trading cease if daily price fluctuations move outside certain limits

Among the oldest futures markets in the United States are those for wheat and corn which date back to the middle of the nineteenth century. Thereafter, futures markets for other farm products and raw materials gradually developed One of their major purposes was to provide producers and processors with price insurance Suppose a farmer expects to harvest wheat in July. Nobody knows with certainty what the price will be then, it depends upon the size of the harvest and conditions elsewhere in the world. However, by selling a futures contract for July wheat, the farmer can indirectly guarantee receiving a particular price This is illustrated in Box 1

Futures markets for commodities not only provide a forum for hedgers, but they also provide information This information—about prices expected to prevail on future dates—is printed in the financial section of many daily newspapers The farmer, for example, can use these futures prices to decide whether to plant corn or wheat The food processor can gear up to can corn or beans depending upon the expected prices and the prospective consumer demand at those prices

Interest rate futures are a relatively new development. In the fall of 1975, the CBT inaugurated a GNMA contract. Shortly thereafter, in early 1976, the IMM introduced a contract for ninety-day Treasury bills, and this was followed in 1977 by the CBT's Treasury bond futures contract These three contracts—the CBT's original GNMA, the CBT's Treasury bond, and the IMM's three-month Treasury bill contract—have proved to be the most popular and heavily traded financial futures contracts The amount of contracts outstanding, or open interest, in these markets has expanded significantly since their inception (Chart 1). Moreover, trading volume has also become quite large in relation to the underlying cash market securities In 1979, daily average trading in the eight ninety-day Treasury bill contracts on the IMM was equivalent to about $7½ billion (at $1 million per contract), not much different from the daily volume of Treasury bills traded in the dealer market for United States Government securites [1] Some interest rate futures contracts, however, have failed to attract much trading activity For example, activity in the ninety-day commercial paper contract has remained quite light [2]

Box 1

Hedge in Wheat Futures

A farmer planning to harvest wheat in July sells a July wheat futures contract at $2 98 in March

(1) Suppose the price in July turns out to be	$2 50	$3 00	$3 50
(2) Gain or loss from offsetting futures contract [$2 98 − row (1)]	48	−.02	− 52
(3) Sales price of wheat in cash market [same as row (1)]	2 50	3 00	3 50
(4) Total earnings per bushel [row (2) ÷ row (3)]	2 98	2.98	2.98

How financial futures markets operate

The financial futures markets operate in the same manner as other futures markets Their terms and methods are very different from those used in the money and bond markets One of the most active financial futures markets is that for three-month Treasury bills at the IMM Through this exchange, a customer could, for example, buy a contract to take delivery of (and pay for) $1 million of three-month Treasury bills on March 20, 1980 In all, there are eight contract delivery months on the IMM, extending at quarterly intervals for about two years into the future

A customer places his order with a futures commission merchant—a firm registered with the CFTC and permitted to accept orders from the public—which

[1] That market is described in "The Dealer Market for United States Government Securities", by Christopher McCurdy in this Bank's *Quarterly Review* (Winter 1977-78), pages 35-47

[2] One of the problems with this contract has been that commercial paper issuers have at times tended to sell paper with maturities much shorter than ninety days Also, because the paper of a large number of companies is deliverable against the contract, this generates substantial uncertainty about which paper will be delivered In addition, the original technical specifications of the contract engendered some confusion

sends the order to the trading floor of the exchange. There, a member of the exchange enters the trading pit and announces his intention to purchase the March 1980 contract. Another member who has an order to sell that contract shouts out his offer and, if the two can agree on a price, the trade is consummated. The trading in the pit is by *open outcry,* which is typical of futures exchanges and very unlike the over-the-telephone negotiations in the cash market for Treasury securities.

The contract's price is quoted as the difference between 100 and the discount rate on the bill in question. Thus, a contract fixing a bill rate of 8.50 percent would be quoted at 91.50 This index preserves the normal futures market relationship in which the party obligated to take (make) delivery profits when the price rises (falls). The contract quote is not the price that would actually be paid for the bill at delivery. That price is computed by using the rate of discount in the standard bill price formula.

The clearinghouse interposes itself between the buyer and the seller, so that the buyer's contract is not with the seller but with the clearinghouse (In the same fashion, the seller's contract is with the clearinghouse and not with the original buyer.)

A key ingredient in the financial viability of the clearinghouse is the margin that the clearing member firms must post on their contracts. For each outright purchase or sale of a three-month Treasury bill contract on the IMM, the firm must post margin of $1,200 per contract, which can be in the form of cash or bank letter of credit. The clearing member firm must, in turn, impose an initial margin of at least $1,500 on the customer. This may be posted in the form of cash, selected securities, or bank letters of credit. Futures firms can and often do require higher than the minimum margins of their customers. Margins formerly were more lenient, at one point down to $800 initial margin, but were raised following the greater volatility that emerged in the financial markets in the wake of the Federal Reserve System's policy actions in October 1979.

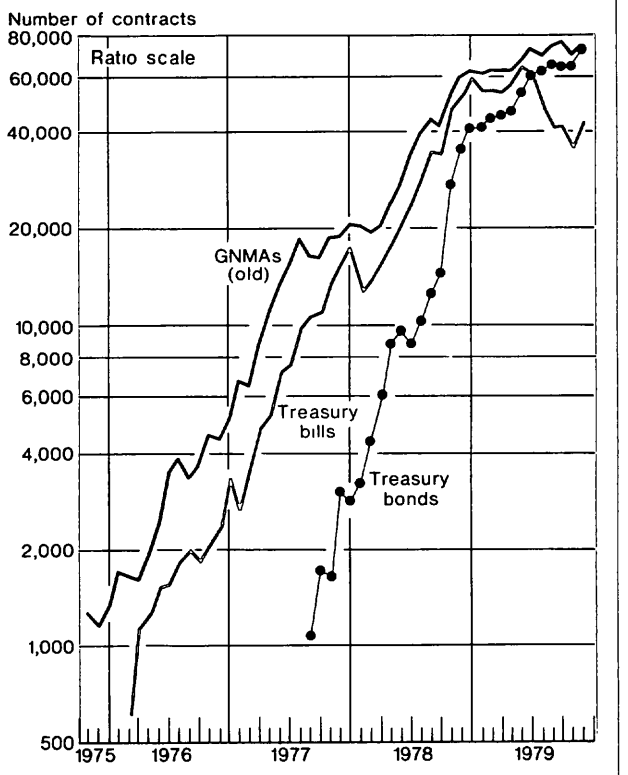
For as long as the position is outstanding, the contract will be *marked-to-market* by the clearinghouse at the end of each business day. For example, a clearing member with a long position in the March contract would have its margin account credited with a profit if the price rises, or debited with a loss if it declines. The prices used in the calculations are the *final settlement prices,* which are determined by the exchange by examining the prices attached to the trades transacted at the end of trading each day.

Profits in the margin account may be withdrawn immediately. When losses occur and reduce the firm's

Chart 1

Growth of Interest Rate Futures Markets: GNMAs, Treasury Bills, and Treasury Bonds

End-of-month open interest



See Box 2 for specifications

Sources International Monetary Market and Chicago Board of Trade

margin below $1,200, the firm must pay the difference to the clearinghouse in cash before trading opens the next day. It is permissible for the value of a customer's margin account to fall below the initial $1,500 but, once the margin account falls below the $1,200 maintenance margin, the account must be replenished in full—brought back up to $1,500. Since the value of a 1 basis point change in the futures bill rate is $25 per contract, relatively small changes in interest rates can result in large changes in the value of a margin account.

The exchanges impose rules that prices may not change by more than a certain maximum amount from one day to the next. At the IMM, for example, no bill futures trades may be cleared if the price is more than 50 basis points above or below the final settlement price on the previous day although, if the *daily limit*

Box 2

Futures Contracts on Treasury Securities (Currently Trading)

	Treasury bills				Intermediate-term Treasury coupon securities		Treasury bonds	
	ACE	*COMEX*	*IMM*	*IMM*	*CBT*	*IMM*	*ACE*	*CBT*
Deliverable items	$1 million par value of Treasury bills with 90, 91, or 92 days to maturity	$1 million par value of Treasury bills with 90, 91, or 92 days to maturity	$1 million par value of Treasury bills with 90, 91, or 92 days to maturity	$250,000 par value of Treasury bills due in 52 weeks	$100,000 par value of Treasury notes and noncallable bonds with 4 to 6 years to maturity	$100,000 par value of Treasury notes maturing between 3½ years and 4½ years	$100,000 par value of Treasury bonds with at least 20 years to maturity	$100,000 par value of Treasury bonds with at least 15 years to first call or to maturity
Initial margin* (per contract)	$800	$800	$1,500	$600	$900	$500	$2,000	$2,000†
Maintenance margin* (per contract)	$600	$600	$1,200	$400	$600	$300	$1,500	$1,600†
Daily limits‡	50 basis points	60 basis points	50 basis points	50 basis points	1 point (32/32)	¾ point (48/64)	1 point (32/32)§	2 points (64/32)
Delivery months (each year)	January, April, July, October	February, May, August, November	March, June, September, December	March, June, September, December	March, June, September, December	February, May, August, November	February, May, August, November	March, June, September, December
Total open interest (December 31, 1979) .	106	913	36,495	435	715	265	207	90,676
Date trading began ...	June 26, 1979	October 2, 1979	January 6, 1976	September 11, 1978	June 25, 1979	July 10, 1979	November 14, 1979	August 22, 1977

Non-Treasury Securities Futures

	Government National Mortgage Association (modified pass-through mortgage-backed certificates)				Commercial paper	
	CBT (old)	*CBT (new)*	*ACE*	*COMEX*	*CBT (30-day)*	*CBT (90-day)*
Deliverable items	Collateralized depository receipt covering $100,000 principal balance of GNMA certificates	$100,000 principal balance of GNMA certificates	$100,000 principal balance of GNMA certificates	$100,000 principal balance of GNMA certificates	$3 million face value of prime commercial paper rated A-1 by Standard & Poor's and P-1 by Moody's	$1 million face value of prime commercial paper rated A-1 by Standard & Poor's and P-1 by Moody's
Initial margin* (per contract)	$2,000	$2,000	$2,000	$1,500	$1,500	$1,500
Maintenance margin* (per contract)	$1,500	$1,500	$1,500	$1,125	$1,200	$1,200
Daily limits‡	1½ points (48/32)	1½ points (48/32)	¾ point (24/32)§	1 point (64/64)	50/100 point	50/100 point
Delivery months (each year)	March, June, September, December	March, June, September, December	February, May, August, November	January, April July, October‖	March, June, September, December	March, June, September, December
Total open interest (December 31, 1979) .	88,982	4,478	3,248	64	12	533
Date trading began ...	October 20, 1975	September 12, 1978	September 12, 1978	November 13, 1979	May 14, 1979	September 26, 1977

All specifications are as of year-end 1979

* The speculative margin is shown where margins vary according to whether the contracts cover speculative, hedged, or spread positions

† For all contracts but those which mature in current month. Then initial margin is increased to $2,500 and maintenance margin is raised to $2,000

‡ Exchanges frequently have rules allowing expansion of daily limits once they have been in effect for a few days (margins may change also)

§ Limits in suspension as of the year-end

‖ Principal trading months; rules allow trading for current plus two succeeding months

restricts trading for a few days, then wider limits may be imposed on subsequent days. Margins are often temporarily increased during such periods.

When the customer wishes to get out of his contract before maturity, he must take an offsetting position. To cancel the contract he bought, he must sell another contract. His order is forwarded to the pit and a sales contract is executed, but not necessarily with the party who sold it to him in the first place. Once again, the clearinghouse interposes itself between the two parties and the latest sale will be offset against the original purchase. The customer's overall position will be canceled, and the funds in the margin account will be returned to him.

The lion's share of all contracts traded are terminated before maturity in this fashion. Only a very small percentage of contracts traded is delivered. In the case of Treasury bills, delivery takes place on the day after trading stops. The customer who has sold the contract (the short) delivers $1 million (par value) of Treasury bills that have ninety, ninety-one, or ninety-two days to maturity, and the customer who bought the contract (the long) pays for the bills with immediately available funds. The price paid for the bills is the settlement price on the last day of trading. (With the daily marking-to-market, almost all losses and gains have been realized before the final delivery takes place.)

Variations in procedures exist on different contracts and exchanges, but they generally adhere to the same principles: open outcry trading, interposition of the clearinghouse, posting of margin, and daily marking-to-market. Box 2 delineates the key specifications on financial futures contracts. Probably the most important difference among contracts is that some allow delivery of a variety of securities. The active Treasury bond contract, for example, permits delivery of bonds from a "market basket" of different bonds, all with maturity (or first call) beyond fifteen years. This has the effect of substantially increasing the deliverable supply of securities but generates some uncertainty among those taking delivery as to which bonds they might receive.

The formal organizational structure of futures trading stands in contrast to the informal nature of forward trading. Dealers in the market for United States Government securities often agree to transact trades that call for forward delivery of Treasury issues. These trades are negotiated in the same fashion as trades for immediate delivery. There is no standardized contract as in the futures market: the two parties must agree to the specific security involved, the exact delivery date, the size of trade, and the price. These terms are set according to the mutual convenience of the two parties. Often, there is no initial margin and no marking-to-market to account for gains and losses. Thus, each participant must size up the creditworthiness of the other. Finally, these agreements, for the most part, are designed to result in delivery. (Some GNMA forward trades among a few firms can be offset through a clearinghouse arrangement.) If either side wishes to cancel the trade, it must go back to the other side and negotiate a termination.

Participants in the interest rate futures markets

Many types of financial institutions participate in the markets for interest rate futures, but private individuals not acting in a business capacity account for the major part of interest rate futures positions in the three most active contracts (Chart 2).

According to a survey by the CFTC of positions outstanding on March 30, 1979, businesses other than the futures industry, commonly called "commercial traders", accounted for only about one quarter of open interest held in the most active contracts (ninety-day Treasury bills on the IMM, and Treasury bonds and the original GNMA contract on the CBT). In an earlier survey, such participants had held about three eighths of those contracts outstanding on November 30, 1977 (Table 1). The involvement of commercial traders is important because they are the only group that can use futures contracts for hedging cash market positions to any meaningful extent. (See next section.)

Moreover, some of the businesses who participate in these futures markets are probably not trying to eliminate risk completely. Consider securities dealers, for example, who have been very active in interest rate futures markets—they held about 7 percent of total GNMA positions and about 18 percent of total bond positions in March 1979. Securities dealers are generally risk takers, trying to benefit from interest rate change, or arbitrageurs, trying to benefit from interest rate disparities, rather than hedgers. But, in meeting customers' needs and making a market in Government securities, they do make use of interest rate futures markets to manage their risk exposure.

Among other business participants, mortgage bankers and savings and loan associations combined held about 7 percent of total positions in GNMAs Their participation in GNMAs is to be expected in view of their involvement in generating and investing in mortgages. A total of sixty-eight of these firms held positions on March 30, 1979, not much above the number reported in the earlier survey. Few commercial banks have been active in interest rate futures—twenty-four had open positions in bill futures, and fourteen in bond futures on March 30, 1979—accounting for a small fraction of total positions in these markets. Their rela-

Table 1

Futures Markets Participants

November 30, 1977 and March 30, 1979
Average open interest, number of contracts

Type of participant	Government National Mortgage Association contract (old)				Treasury bond contract				Three-month Treasury bill contract			
	1977 amount	1977 as percentage of total	1979 amount	1979 as percentage of total	1977 amount	1977 as percentage of total	1979 amount	1979 as percentage of total	1977 amount	1977 as percentage of total	1979 amount	1979 as percentage of total
Commercial traders *(total)*	*7,226*	*36 5*	*10,899*	*18 3*	*2,025*	*67 2*	*12,393*	*27.4*	*4,950*	*32 8*	*14,992*	*33 6*
Securities dealers	3,395	17.1	4,270	7.2	1,534	50 9	8,226	18 2	2,758	18 3	5,596	12.5
Commercial banks	263	1.3	655	1.1	99	3 3	1,472	3.3	326	2 2	1,581	3.5
Savings and loan associations	494	2 5	2,500	4 2	—	—	394	0 9	56	0 4	136	0 3
Mortgage bankers	1,198	6.1	1,472	2.5	154	5.1	330	0 7	44	0 3	974	2 2
Other	1,875	9.5	2,003	3 4	238	7 9	1,971	4 4	1,767	11.7	6,706	15.0
Noncommercial traders *(total)*	*12,588*	*63 5*	*48,705*	*81.7*	*989*	*32.8*	*32,826*	*72.6*	*10,154*	*67.2*	*29,661*	*66 4*
Futures industry	7,353	37 1	21,113	35 4	477	15 8	12,924	28 6	2,765	18 3	8,434	18.9
Commodity pools	2,862	14.4	11,097	18.6	254	8 4	9,484	21 0	1,520	10 1	5,640	12 6
Individual traders	2,373	12 0	16,495	27 7	258	8.6	10,418	23 0	5,868	38.8	15,586	34.9
Total	**19,814**	**100**	**59,604**	**100**	**3,014**	**100**	**45,219**	**100**	**15,104**	**100**	**44,654**	**100**

Because of rounding, amounts and percentages may not add to totals.
Source: Commodity Futures Trading Commission Surveys The 1977 survey covered all positions, but the 1979 survey excluded positions of fewer than five contracts.

tively low level of participation may have reflected regulatory restrictions on their involvement in the futures market or some confusion about the regulators' policies.

Futures industry personnel and firms held a significant fraction of the open positions. This group includes many who are speculating on rate movements in general or on the spread relations between rates on successive contracts. Or they might be operating in both the cash and futures markets, arbitraging differences between the two markets.

Individuals and commodity pools—funds which purchase futures contracts—are very important participants in financial futures markets. They held almost half of the open positions in 1979, a substantial increase from their already significant participation in the earlier survey. Indeed, their 1979 share of total positions in financial contracts was certainly higher than that because positions of less than five contracts were not included in the second survey and individuals tend to hold the vast majority of such small positions.[3]

Services provided by interest rates futures markets

It is commonly believed that futures markets provide certain benefits—in the main, an inexpensive way to hedge risk and generate information on expected prices. Interest rate futures markets also provide these benefits.

Several observers have noted that interest rate futures markets are not necessary to provide information on future interest rates or as a hedging mechanism. They point out that one can obtain information

[3] Small positions in the bill futures contracts amounted to about 8,000 contracts at the end of March 1979 and thus would raise the combined share of individuals and commodity pools to a bit more than half of the bill futures market Comparable calculations cannot be made for the CBT's bond and GMNA contracts because some small positions are posted on a net basis (*i e*, long positions are offset against short positions), compared with a gross basis as in the bill contracts

on future interest rates by comparing yields on outstanding securities which have different maturities However, the interest rate futures markets do provide future interest rate information in a more convenient form.

It is also true that outstanding securities could be used to hedge market risk Again, however, the futures market can provide a less cumbersome and expensive hedge. Suppose, for example, that a firm is planning to issue short-term securities three months in the future and is worried about the prospective short-term interest rate The short sale of a Treasury bill with more than three months to maturity is one way to hedge the risk.[4] In the futures market, the interest rate risk on this prospective issue could be hedged by selling the Treasury bill contract for the month closest to the prospective issue date. If all short rates moved up, the hedger would make a gain on the futures market transaction which would offset the loss on the higher interest rate he would have to offer.

Banks, dealers, and other such financial institutions may find futures markets helpful in achieving a particular maturity structure for their portfolios while having adequate supplies of cash securities on hand. For example, a dealer may need to hold supplies of a six-month bill to be ready for customer orders. However, he may not want the risk exposure on this particular maturity because he thinks its rate is likely to rise Or, a mortgage banker may wish to hedge the risk on rates between the time of the mortgage loan and the time of its sale as part of a large package of loans By selling a GNMA futures contract while assembling the mortgage package, the banker can be insured against rate changes If rates rise, the value of the mortgage portfolio will fall, but that will be offset by the profits on the short sale of the GNMA contract If, on the other hand, rates fall, the gain on the mortgage portfolio is offset by the loss on the sale of GNMA futures In this hedge, the banker foregoes the possibility of additional profit (or loss) and is content to profit from the origination and servicing fees associated with assembling the mortgages

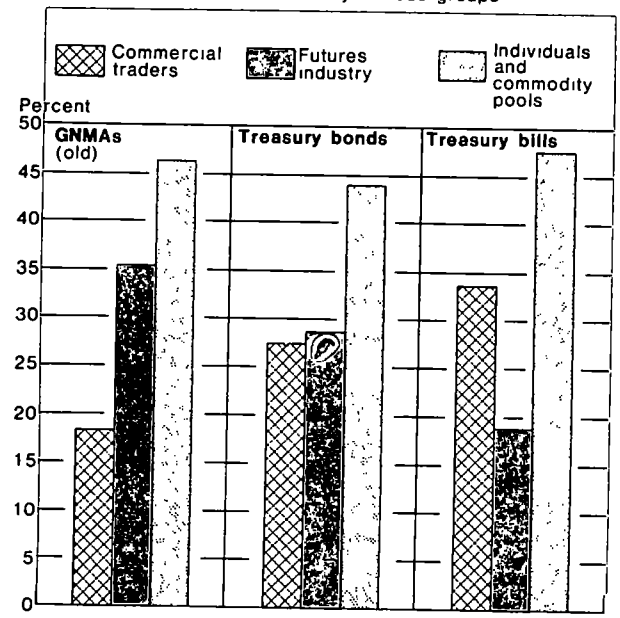
Not every financial transaction has an exact hedge in the futures market. When the cash asset is different from the security specified in the futures contract, the transaction is called a "cross hedge" and provides much less protection than an exact hedge For example, a securities dealer might find it profitable to buy some certificates of deposit (CDs) and finance them for one month. To protect against a decline (increase) in the price (rates) of CDs over the interval, the dealer might sell Treasury bill futures contracts, assuming the movements in bill rates and CD rates will be similar over the interval. So long as the rates move in the same *direction* the dealer will be protected at least to some degree against adverse price movements. It is conceivable, however, that the rates could move in opposite directions. Thus, a cross hedge is really a speculation on the relationship between the particular cash market security held in position and the particular futures contract involved In a cross hedge, the participants cannot deliver the cash security against the contract, so there is no threat of delivery that can be used to drive the prices on the two securities back into line as the expiration date approaches

In contrast to financial businesses, nonfinancial businesses and private individuals are less likely to find a useful hedge in the interest rate futures market Consider the typical nonfinancial business which is planning to issue securities to finance some capital

Chart 2

Futures Markets Participants, March 30, 1979

Shares of open interest held by various groups



Source Commodity Futures Trading Commission

[4] The prospective issuer could borrow a six-month Treasury bill and sell it immediately, three months hence he would buy a bill with the same maturity date to return If interest rates for that future time interval rise, the security would be purchased more cheaply three months hence than is currently expected The gain on this transaction would then offset the loss connected with issuing securities at the higher interest rate

purchase or inventory If the rate of inflation accelerates, the firm will typically be able to sell its output at higher prices Thus, its nominal profit and return from the investment will typically also rise[5] This means that a rise in inflationary expectations, which is reflected in the nominal rate of interest, will tend to affect profits in the same direction as it does financing costs. Thus, to some extent, the firm is automatically hedged against inflation-induced changes in the interest rate

A similar intrinsic hedge may be available to investors on any new funds they plan to invest. Presumably they want to be sure that their investment produces a certain real income or purchasing power in the future If interest rates move down because anticipated inflation has fallen, then the return on any funds invested at the lower rate will be able to buy the same quantity of goods and services that they would have in the circumstance where inflation and interest rates were higher (The real return on *past* savings, however, will move in the opposite direction as inflation)

Thus, to the extent that interest rate changes reflect revisions in inflationary expectations, many businesses and persons will not be in a very risky position with regard to saving or investment plans. If, as some contend, the variation in interest rates is largely connected with inflationary expectations, these groups would typically not obtain a very useful hedge in the interest rate futures market.

Speculation

While some participants use futures markets to hedge risk, others use them to speculate on price movements Speculators like the high leverage obtainable and the low capital required for trades in futures markets relative to trades in cash markets Speculation on interest rates could be accomplished in the cash markets but would typically involve greater costs than in futures markets. For example, suppose one thinks that the three-month interest rate in the June-September period will be higher than the implicit forward rate for that time interval The short sale of a September bill in March and its repurchase in June can produce a profit if those high rates materialize. The costs involved in these transactions include the dollar value of the bid-ask spread as well as the charges for borrowing a security In addition, one must have sufficient capital to put up collateral equivalent in value to the securities borrowed or the credit standing to borrow the securities under a reverse repurchase agreement.

In futures markets, one does not pay for or receive money for the commodity in advance The cost of trading in the futures market is the foregone interest on the margin deposit (if in the form of cash) plus the commission fees. Assuming a $70 commission, this would amount to about $125 on a three-month bill futures contract at current interest rates, if the contract were held for three months A change in the discount rate on the futures contract of 5 basis points would therefore recompense the speculator for his costs (Table 2).

Besides speculating on the level of rates, some futures market participants may be speculating on the relationship among interest rates Such speculation can take the form of a "spread" trade whereby the participant buys one contract and sells another, hoping that the rate on the contract bought will fall by more than (or rise by less than) the rate on the contract sold Also, if participants believe that the slope of the yield curve will change in a predictable way when the level of the yield curve changes, a spread transaction (which involves a lower margin) can be a less expensive way to speculate on the level of rates

Frequently, traders will take positions in futures contracts that are related to positions in cash market securities A trader might think that the rate in the futures market is out of line with cash Treasury bills If he feels the futures rate is low relative to the rates

Table 2

Change in Discount Rate on a Three-Month Treasury Bill Futures Contract Necessary to Cover Cost of a Futures Market Transaction

In basis points

Holding period	Commission (in dollars) $30	$50	$70
One month	2 0	2 8	3·6
Three months	3 4	4 2	5 0
Six months	5 7	6 5	7 3
Twelve months	10 2	11 0	11 8

$$\text{Basis point change} = \frac{C + \frac{h(01i)m}{12}}{25}$$

where h is the number of months the contract is held, i is the rate of interest obtainable over the period h, m is the cash margin, and C is the commission on the futures trade
The numbers shown are based upon i = 15 percent and m = $1,500

[5] The firm does not, however, tend to earn nominal profits in proportion to prices because the tax structure collects more in real terms during inflation See M Arak, "Can the Performance of the Stock Market Be Explained by Inflation Coupled with our Tax System?" (Federal Reserve Bank of New York Research Paper)

on outstanding bills, he might sell the futures contract and buy the bills in the cash market. He could then carry the bill in position until the two rates move back to their more normal relationship. Then the bills would be sold and the short bill futures contract offset. These types of trades are often called "arbitrages" by participants in the cash market although they are not arbitrages in the strict sense in which a security is bought in one market and at the same time sold in another, thereby locking in an assured return. In fact, most arbitraging activity generally reflects speculation on the relationship between cash and futures rates.

Use of futures markets to reduce tax liability

Individuals and institutions have also used interest rate futures markets to reduce their taxes. One means was through spread transactions.

Until November 1978, spread transactions in the Treasury bill futures market were a popular means of postponing taxes. An individual would buy one contract and sell another, both for the next calendar year. For example, in 1976, the participant might have bought the March 1977 contract and sold the September 1977 contract. An important assumption was that interest rates on all contracts would tend to move together so that the net risk was relatively small. At some point before the end of 1976, whichever position had produced a loss would be closed out. (In the above example, the short position or the sale of the September 1977 contract was the item that showed a loss during the latter part of 1976.) That loss could then be deducted from other income for 1976, reducing the 1976 tax bill. The contract for March 1977, on which the gain had accrued, was not closed out until 1977 when it no longer affected the 1976 tax liability.[6]

What made Treasury bill futures particularly attractive for such spreads was the belief of many taxpayers that, just like actual Treasury bills, they were not capital assets. In contrast, it was clear that other types of futures contracts, not held exclusively for business purposes, were capital assets.[7] If Treasury bill futures were not capital assets, then losses on them could be fully subtracted from other ordinary income (providing that *net* ordinary income did not become negative). Capital losses, in contrast, could be subtracted from ordinary income to a very limited extent.[8]

This attraction of the Treasury bill futures market for tax postponement was eliminated in November 1978 when the IRS declared that a futures contract for Treasury bills is a capital asset if neither held primarily for sale to customers in the ordinary course of business nor purchased as a hedge.[9] Further, the IRS, amplifying on an earlier ruling,[10] stated that the maintenance of a "spread" position, in transactions involving futures contracts for Treasury bills, may not result in allowance of deductions where no real economic loss is incurred.

A way that individuals can reduce taxes through the futures market is by indirectly converting part of the interest income on Treasury bills into long-term capital gains. Suppose that the discount rate on a bill is expected to fall as it matures. Since the market usually regards longer dated bills as less liquid (or as having more interest rate risk), an investor would typically expect that a bill maturing in, say, March 1981 would offer a higher annual discount rate in June 1980 than it would in February 1981. Similarly, the interest rate on futures contracts would tend to fall as they approach expiration (their price would rise). Pursuant to the November 1978 IRS ruling, the price increase in a Treasury bill futures contract should, in nonbusiness circumstances, be treated as a capital gain for an investor. In contrast, since a Treasury bill itself is not a capital asset, all the price appreciation on it—from date of purchase to date of sale—would be treated as ordinary income for tax purposes.

An investor would clearly prefer to have the price appreciation treated as a long-term gain rather than as ordinary income, since the long-term capital gains tax rate is only 40 percent of that for ordinary income. If a long position in a bill futures contract were held for more than six months, the profit would be a long-term capital gain. (Gains and losses on short positions in futures are always treated as short-term regardless of the holding period.) Consequently, some investors who might normally purchase 52-week bills would have an incentive to purchase distant futures contracts and, as those contracts matured, sell them off to take their capital gains. They could then invest their funds in three-month bills. These activities would tend to raise the discount rate on the 52-week bill. It would also tend to reduce the required discount rate on distant futures contracts. Thus, the discount rates on futures contracts would be pushed below the implicit forward discount rate on cash bills

There are, of course, limits on the size of the wedge that can be driven between the forward rate on

[6] After the September 1977 contract was offset, another contract for 1977 would be sold to maintain a balanced position In our example, the June 1977 contract would be sold to counterbalance the March 1977 contract that was still being held Then sometime in early 1977, these two contracts would be closed out

[7] *E g* , Faroll v Jarecki, 231 F 2d 281 (7th Cir 1956)

[8] Capital losses can be offset against capital gains with no limitation, but the excess of loss over gains that may be deducted from ordinary income in a single year is currently limited to $3,000

[9] Rev Rul 78-414, 1978-2 C B 213

[10] Rev Rul 77-185, 1977-1 C B 48

cash securities and the rate on futures contracts. Financial businesses cannot treat profits in bill futures as capital gains. For them, the futures contract has no tax advantage over a cash bill. When the wedge produced by investors exceeds the cost of arbitrage, these financial businesses will buy long-term bills and sell futures contracts to profit from the disparities in rates.

Relationship between the cash and futures markets

For many commodities, the spot price and the futures price are very closely related. Part of the explanation is that, if a commodity is storable, it can be bought today, stored, and sold at a future date. If the futures price were to exceed the spot price by more than the costs involved, arbitrageurs would buy the commodity in the spot market—raising the spot price—and would sell it in the futures market, lowering the futures price. These activities would reduce the disparity between the future price and the current price.

The relationship between cash and futures markets for bills is somewhat different from that for other commodities. A three-month Treasury bill cannot be stored for more than three months; it matures. However, a longer term bill could be "stored" until it has three months left to run. It is the cash market for that *longer term bill* which bears a relationship to the futures market that is typical of agricultural and industrial commodities. In the case of note and bond contracts, the deliverable item exists throughout the life of the contract.

For example, consider what cash market securities correspond to the IMM's June 1980 three-month Treasury bill contract. This contract calls for delivery of bills which have ninety-one days to run on June 19, 1980. Treasury bills having this maturity date will be sold by the Treasury in two auctions—as six-month bills on March 17, 1980 and as three-month bills on June 16, 1980. During the first three months of its life, the six-month bill issued on March 20, 1980 is the commodity that could be "stored" for delivery on the futures contract.

The funds used to purchase the six-month bill when it is initially issued could have been invested in three-month bills which mature on the contract expiration date. One measure of the interest cost involved in storage is therefore the foregone interest on the shorter bill —this is the "opportunity cost" of the decision to invest in the longer bill which is deliverable on the futures contract. It is common to subtract that opportunity cost from the bill price to get the "forward" price and the corresponding "forward" rate; this rate can then be compared with the discount rate on the futures contract.

Because in the past only three-month and six-month bills matured on Thursdays, only bills originally issued as three-month or six-month bills could be delivered on a ninety-day bill futures contract.[11] In fact, at any date, there was only one bill issue in existence that could be delivered on an IMM bill futures contract. That particular bill had between three and six months to maturity and could be delivered on the closest three-month bill futures contract. For longer bill futures contracts, there was usually no exact correspondence. There is no cash bill in existence today that could be delivered on the September 1980, December 1980, March 1981, and subsequent contracts traded on the IMM. However, there are bills which have a maturity date that may be quite close. For example, the 52-week bill maturing on September 16, 1980 will have eighty-nine days to run on June 19, 1980, while the June futures contract calls for bills which have ninety to ninety-two days to run on that date. By comparing the rate on this 52-week bill with the rate on the 52-week bill which matures twelve weeks earlier, a forward rate which covers an interval close to that of the futures contract bill can be calculated. Through this method, a rough forward rate in the period nine months prior to the contract's expiration can be obtained.

How does the rate on a three-month Treasury bill futures contract compare with the implicit forward rate in the cash market? The futures rate on the June 1979 contract and the "forward" rate on the corresponding cash bill (which matured September 21, 1979) moved very similarly in the last ninety-one days before the futures contract expired (Chart 3). Typically, the spread between the two rates was less than 25 basis points, with the forward rate somewhat higher than the futures rate. On most other futures contracts for three-month Treasury bills as well, the futures and forward rates were fairly close in the last ninety-one days or so before expiration.

When the contract's expiration date was far in the future, however, the link between its rate and the comparable forward rate was much weaker. In fact, spreads between forward and futures rates have at times been over 100 basis points in the three to nine months before the contract expired. Generally, in recent contracts, futures rates have been substantially below forward rates, and the spread between the two appears to have been wider than it was in earlier contracts

Within three months of the expiration of the futures contract, futures and forward rates appear to be kept in reasonable alignment by investors and arbitrageurs. An investor, for example, can on the one hand hold a

[11] Now that the Treasury has begun to issue 52-week bills maturing on Thursdays, there will be some occasions on which bills issued as 52-week bills will be deliverable against the three-month bill contracts

six-month bill, or, on the other hand, hold a three-month bill plus the futures contract for the month in which the three-month cash bill matures. If the six-month bill is yielding more than the other combination, investors will tend to prefer six-month bills. And their demand will tend to reduce its discount rate, bringing the forward rate down toward the futures rate. Similarly, if investors find the three-month cash bill plus the futures contract more profitable, their buying pressure on the futures contract will tend to reduce its discount rate, bringing it down closer to the forward rate.

Another group of market participants who help keep rates in line are arbitrageurs. If they observe that the six-month bill provides a forward rate which is high relative to the futures rate, they could buy six-month bills and sell them under a repurchase agreement for three months;[12] at the same time, they would sell a futures contract. They would then have no net investment position: the bill returned to them in three months corresponds to the commitment to sell in the futures market. But they would earn a profit equal to the futures price minus the six-month bill price, the transaction cost, and the financing cost. As arbitrageurs conduct these activities, they put upward pressure on the six-month bill's price by buying it and put downward pressure on the futures price by selling the futures contract. These activities of the arbitrageur usually tend to keep the forward and futures rates within certain bounds.

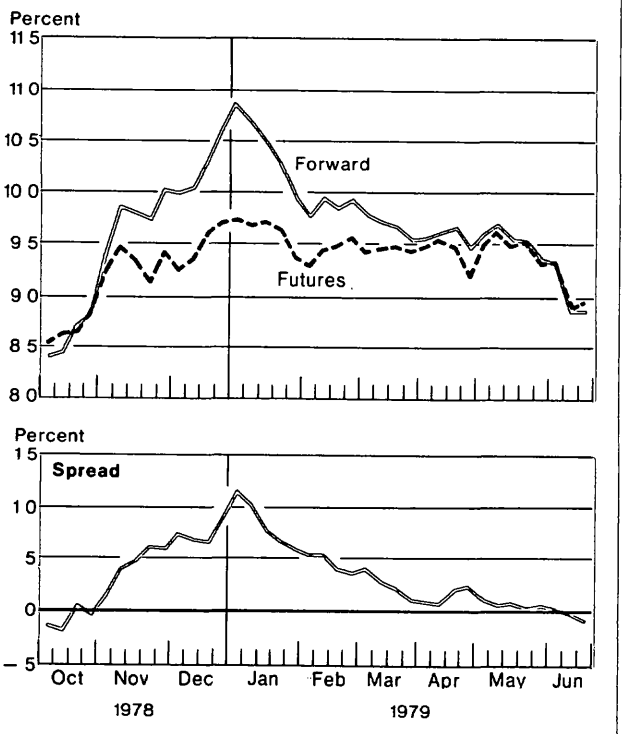
On contracts other than the nearest, however, there is no deliverable bill as yet outstanding—that is, no security exists that can be purchased, stored, and delivered against the contract. Consequently, arbitrageurs cannot lock in a profit by taking exactly offsetting positions in the two markets. If there is an order flow in the futures market that is persistent, sizable, and at variance with the prevailing view in the cash market, it is possible for speculators to drive a wedge between the rates on futures contracts and the implicit forward rates in the cash market.

One notable example occurred in the spring of 1979. Apparently, many small speculators purchased bill futures contracts due in mid-1980, in the belief that short-term interest rates had reached a cyclical peak and would begin to fall sometime within a year or so. From the end of April to the end of June, their holdings rose from about 25 percent to 35 percent of the total open interest and their net long positions expanded sharply. As a result of this buying pressure and purchases by those trying to get out of large

[12] A repurchase agreement specifies that the seller will rebuy at a prespecified date and price

Chart 3

Discount Rate on the June 1979 Treasury Bill Futures Contract (IMM) and the Forward Rate in the Cash Market



Spread equals forward rate minus futures rate

short positions, rates dropped sharply, with the March 1980 and June 1980 contract rates falling by nearly 1¾ percentage points from mid-May to the end of June. Rates also fell on contracts with shorter maturities—those due in the latter half of 1979.

Many other participants were net short, and some of these were firms that felt they were arbitraging between the cash and futures market, holding in this case long positions in the cash bill market against short positions in futures contracts. One of the several cash futures operations they engaged in was a long position in bills in the six-month area *(i.e.,* due in November for the most part) versus a short in the September contract (calling for delivery of the bill to mature on December 20 which had not been auctioned yet). As the rates on futures contracts fell, those with short positions faced sizable margin calls. To the extent that they then bought futures contracts to offset their short positions and also sold their cash bills, they greatly enlarged the wedge that was being driven be-

tween the rates in these two markets in late May and early June (Chart 4)

The widening wedge between the forward and futures rates made arbitrage involving futures contract sales even more profitable But, after the shock of seeing large losses mount on short positions and show up in quarterly income statements, financial businesses were reluctant to expand their short positions. The futures and forward rates did not come back into alignment until late in the summer when interest rates started rising again.

Pros and cons of interest rate futures markets

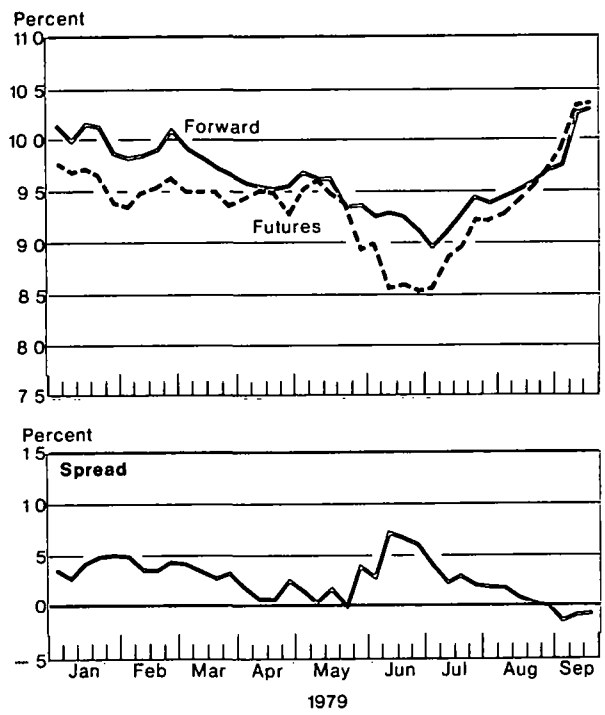
Many observers of the new financial futures markets argue that these markets permit investors to obtain flexibility in ownership of securities at a very low cost. Someone who expects to have funds to invest in the period from mid-June to mid-September 1980, for example, can lock in an interest rate by purchasing a June Treasury bill futures contract (For those who plan to purchase or issue other securities such as commercial paper or CDs, the links between the movements of rates in the bill futures market and the rates that obtain on these other instruments can be weak.)

By transferring the interest rate risk to those most willing to assume it, interest rate futures may increase the commitment of funds for some future time intervals This could reduce the premium attached to funds committed for that future interval relative to funds committed for the nearer term For example, the yield on 52-week and nine-month bills might fall The resulting greater liquidity represents a gain to investors, while the lower interest rate on Government debt reduces the taxes necessary to service that debt

While the provision of hedging facilities is a desirable aspect of interest rate futures markets, much of the activity appears to be speculative, and this has created some concern One such concern is that speculation in the futures markets might push the prices of certain Treasury bills out of line with the

Chart 4

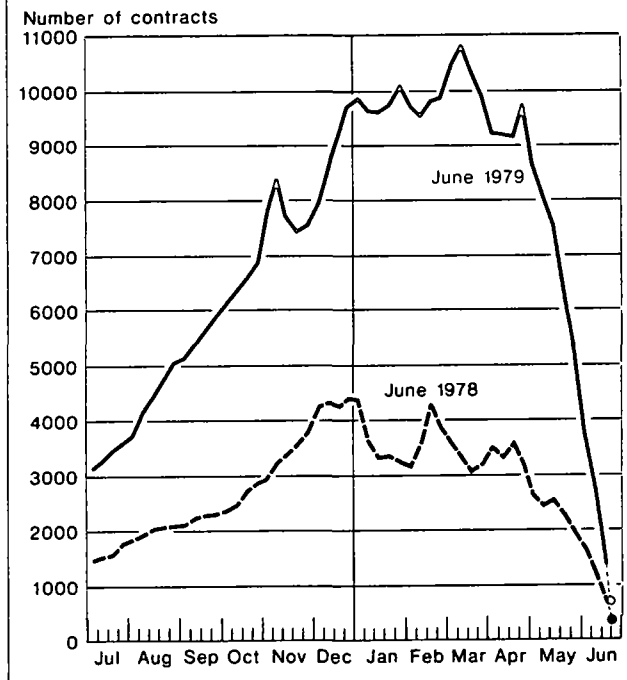
Discount Rate on the September 1979 Treasury Bill Futures Contract (IMM) and the Forward Rate in the Cash Market



Spread equals forward rate minus futures rate

Chart 5

Open Interest in Treasury Bill Futures Contracts for June 1978 and June 1979



Weekly averages, week ending each Wednesday
Total open interest as of last trading day is indicated by dots

Source International Monetary Market

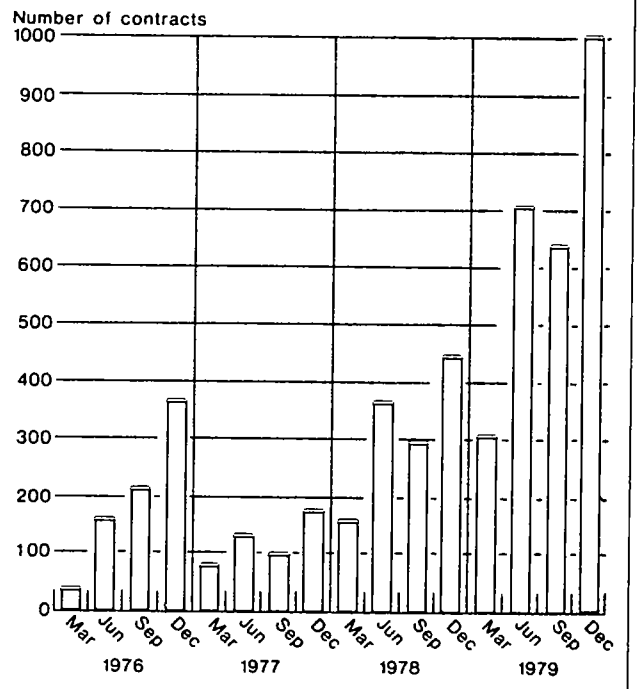
prices of other securities Because speculation is very inexpensive, entry into the futures market could be much more massive than entry into the cash market Heavy demand in the futures market could be transmitted to the cash market by arbitrageurs According to some analysts, the bill deliverable on the June 1979 contract was influenced by activities in the futures market The June contract specified delivery on the Treasury bill due September 20 and only that bill While the Treasury had sold $5 9 billion of bills with that maturity date, the Federal Reserve, foreign official accounts, and small investors held about one half Thus, it appeared likely that the available trading supplies would amount to about $2 billion to $2½ billion

However, open interest in the June 1979 contract stood at about 4,300 contracts, the equivalent of about $4 3 billion of bills at the end of May (Chart 5) This substantially exceeded the prospective trading supplies During the spring, dealers reported that trading supplies in the September 20 bill were very thin and that it traded at a rate that was out of line with other bills For example, it averaged about 4 basis points below the rate on the bill that was due a week earlier Since investors usually require a higher rate when extending the maturity of their bill holdings, the 4 basis point difference provides a rough lower limit on the pressure that was exerted on the June contract and its spillover on the cash market

Some observers argued that some investors were desirous of taking delivery because they thought there would be further declines in interest rates Others pointed out that some people who had booked gains on long positions wanted to qualify for long-term capital gains In any event, about a week before the contract expiration there was news of large increases in the money supply and industrial production which the market interpreted as indicating that a recession was not imminent and that interest rates would not fall immediately This view probably contributed toward reducing pressure on the contract, and it was liquidated in an orderly fashion Deliveries turned out to be a then record high of $706 million of bills due September 20, 1979, about a third of the available trading supplies of that bill Deliveries on the September contract were somewhat lower, although still sizable (Chart 6), and deliveries on the December contract amounted to $1 billion [13] Over the last month before delivery, the rate on the bill deliverable on the December contract

Chart 6

Deliveries on Three-Month Bill Futures Contracts



Source International Monetary Market

averaged 8 basis points below the rate on the bill due one week earlier As a result of these events, the question arises whether supplies of the deliverable bill are sufficient to prevent pricing dislocations

In contrast to bill futures, other futures contracts, notably in notes and bonds, have adopted a market basket approach to deliverable supplies By allowing a variety of issues to be delivered, the contracts greatly reduce the possibility of a squeeze If, for example, the September 13 bill had also been deliverable against the June contract, then traders would have had no incentive to deliver the September 20 bill at a rate that was below that on the September 13 bill The mere availability of the other bill would therefore have provided a floor for the rate on the September 20 bill.

This analysis of bill futures has led some to suggest that, instead of a single deliverable issue, the deliverable security should be any one of a "basket" of Treasury bills with different maturity dates However, others see disadvantages with the "basket" approach. In any event, the CFTC has authorized the new exchanges such as the ACE and the Comex to trade

[13] A part of the large amount of deliveries on the three 1979 contracts may reflect investors' preference for ordinary income losses instead of capital losses, a transformation that can be achieved by taking delivery on a contract on which one has booked a loss See Arak, "Taxes, Treasury Bills, and Treasury Bill Futures"

futures which involve bills maturing in a different week of the quarter than the IMM bill contracts. If these markets grow and become more active, there should be less likelihood of pressure on the one particular March, June, September, or December bill whose futures contract is traded on the IMM.

Finally, to many of the regulators, the size of the required margin deposit is a key issue. Larger margins would help insure the exchanges against possible defaults as well as discourage excessive speculation with little capital. Moreover, they might make participants more aware of the possibilities of loss inherent in trading in interest rate futures. In early October 1979, the minimum initial margin on Treasury bill futures contracts at the IMM was only $800, and a 32 basis point move in the rate on one of those contracts could have wiped out the entire margin. Now that margin is $1,500, which gives better protection to the exchange and the contract.

Concluding remarks

Interest rate futures markets have generated much new activity within a very short time; they have also generated some apprehension on the part of those concerned with orderly marketing and trading of the United States Government debt. Thus far, neither the extreme enthusiasm nor the worst worries appear to be justified.

Interest rate futures markets can provide inexpensive hedging facilities and flexibility in investment. But, to date, participation by financial institutions that might have such a need has not been large. Rather, it appears that participants have so far been primarily interested in either speculating on interest rates or reducing tax liabilities. These participants have been encouraged by fairly low margins. Until recently, the exchanges had shown a penchant for reducing these margins, but in October 1979 when interest rates fluctuated widely following the Federal Reserve System's adoption of new operating procedures, several exchanges raised margins substantially.

Most of the time, the financial futures markets have operated fairly smoothly. In general, there has been no greater volatility in the prices of bills which are deliverable on futures contracts than in the prices of other bills. And despite the huge run-up in open interest in some of the bill futures contracts, actual deliveries have not been large enough to disrupt the operation of the cash market. However, on several bill futures contracts, the price of the deliverable bill was pushed slightly out of line with prices on other issues with adjacent maturities. The CFTC, the Treasury, the Federal Reserve, and market participants themselves will have to continue to observe futures market activities to assure that significant problems are not building up.

Interest rate futures markets have already provided an arena for some institutions to manage interest rate risk. And, as these markets mature, their economic usefulness may come to be more widely appreciated.

Marcelle Arak and Christopher J McCurdy