

GENERAL DESCRIPTION

In 1989, the Brady plan, named after then-U.S. Treasury Secretary Nicholas Brady, was announced to restructure much of the debt of developing countries that was not being fully serviced due to economic constraints. The plan provided debt relief to troubled countries and, in theory, opened access to further international financing. It also provided the legal framework to securitize and restructure the existing bank debt of developing countries into bearer bonds. Linking collateral to some bonds gave banks the incentive to cooperate with the debt reduction plan.

Brady bonds are restructured bank loans. They comprise the most liquid market for below-investment-grade debt (though a few Brady countries have received investment-grade debt ratings) and are one of the largest debt markets of any kind. Banks are active participants in the Brady bond market. Once strictly an interbank market, the Brady market has evolved into one with active participation from a broad investor base.

CHARACTERISTICS AND FEATURES

Brady bonds have long-term maturities, and many have special features attached. Callable bonds or step-up coupons are among the most common features. Others pay additional sources of income based on various economic factors or the price of oil. Listed below are the individual characteristics of several types of Brady bonds:

- *Par bonds* have fixed coupons or coupon schedules and bullet maturities of 25 to 30 years. Typically, these bonds have principal-payment and rolling interest-rate guarantees. Because pars are loans exchanged at face value for bonds, debt relief is provided by a lower interest payment.
- *Discount bonds* have floating-rate coupons typically linked to LIBOR. These bonds have principal and rolling interest-rate guarantees. Bond holders receive a reduced face amount of discount bonds, thereby providing debt relief.

- *Front-loaded interest-reduction bonds* provide a temporary interest-rate reduction. These bonds have a low fixed-interest rate for a few years and then step up to market rates until maturity.
- *Debt conversion bonds (DCBs) and new money bonds* are exchanged for bonds at par and yield a market rate. Typically, DCBs and new money bonds pay LIBOR + 7/8. These bonds are amortized and have an average life of between 10 and 15 years. DCBs and new money bonds are structured to give banks an incentive to inject additional capital. For each dollar of new money bond purchased, an investor converts existing debt into a new money bond at a fixed proportion determined by the Brady agreement. DCBs and new money bonds are normally uncollateralized.

The terms of local debt market instruments also vary widely, and issues are denominated in either local or foreign currency such as U.S. dollars. Brief descriptions of instruments in Argentina, Brazil, and Mexico follow.

Argentina

Letes are Argentine Treasury bills. They are offered on a discount basis and have maturities of 3, 6, and 12 months. Auctions are held on a monthly basis.

Brazil

Currently, the primary internal debt instruments issued in Brazil are so-called BBC bonds, which are issued by the central bank. As of mid-1996, BBC bonds were being issued in 56-day denominations, up from 35-, 42-, and 49-day denominations. Total outstandings as of June 30, 1996, were U.S.\$49.9 billion, and these instruments are highly liquid. The central bank also issues bills and notes known as LTNs and NTNs that have maturities up to one year (though one NTN has been issued as of this writing with a two-year maturity). LTNs and NTNs are less liquid and have smaller outstandings (U.S.\$34.4 and U.S.\$18.2 billion, respectively) than BBC bonds.

Mexico

Ajustabonos

Though issuance of these bonds has been halted, ajustabonos are peso-denominated Treasury bonds. They are indexed to inflation and pay a real return over the Mexican consumer price index (CPI). These bonds are longer-term instruments with maturities of 1,092 days (three years) and 1,820 days (five years). Ajustabonos pay a quarterly real rate coupon over the CPI and are tax exempt to foreign investors. As of May 1996, U.S.\$5.6 billion ajustabonos remained outstanding.

Bondes

Bondes are floating-rate, peso-denominated government development bonds. They have maturities of 364 and 728 days. Bondes pay interest every 28 days at the higher of the 28-day cetes rate or the retail pagares rate, calculated by the central bank. They are auctioned weekly and are tax exempt to foreign investors. The total amount outstanding as of mid-1996 was approximately U.S.\$5 billion.

Cetes

Cetes are government securities and are the equivalent of Mexican T-bills. They are denominated in pesos and are sold at a discount. Cetes have maturities of 28, 91, 182, 364, and 728 days (though this maturity is presently discontinued). Cetes are highly liquid instruments and have an active repo market.

The capital gain for these instruments is determined by the difference between the amortized value and the purchase price; the day-count convention is actual/360-day. Auctions are held weekly by the central bank for the 28-through 364-day maturities. Foreign investors are exempted from paying taxes on these instruments.

Tesobonos

Though these instruments are not currently being issued, they comprised the majority of debt offerings in the time leading up to the 1994 peso crisis. Tesobonos are dollar-indexed govern-

ment securities with a face value of U.S.\$1,000. At the investors' option, they are payable in dollars, and they are issued at a discount. Maturities include 28, 91, 182, and 364 days.

UDIBonos

During the week of May 27, 1996, the Mexican central bank sold three-year UDIBonos for the first time. They are inflation-adjusted bonds denominated in accounting units or UDIs (a daily inflation index), which change in value every day. These instruments replaced the ajustabonos. UDIBonos pays interest semiannually and offer holders a rate of return above the inflation rate. They are auctioned biweekly and may have limited liquidity.

USES

Brady bonds and local debt market instruments can be used for investment, hedging, and speculation. Speculators will often take positions on the level and term structure of sovereign interest rates. Arbitragers will take positions based on their determination of mispricing.

DESCRIPTION OF MARKETPLACE

Issuing Practices

A Brady deal exchanges dollar-denominated loans for an agreed-upon financial instrument. These instruments include various debt instruments, debt equity swaps, and asset swaps. At the close of a collateralized Brady deal (not all Brady bonds are collateralized), collateral is primarily posted in the form of U.S. Treasury zero-coupon bonds and U.S. Treasury bills. The market value of this collateral depends on the yield of 30-year U.S. Treasury strips and tends to increase as the bond ages. Developing countries have also used their own resources for collateral as well as funds from international donors, the World Bank, and the International Monetary Fund (IMF) to support their Brady deals. Local debt instruments are subject to the issuing practices of each individual country.

Market Participants

The number of market participants in each emerging market differs with the characteristics of each market, such as regulatory barriers, liquidity constraints, and risk exposures. However, there are many participants in the Brady bond market. Securitization of Brady bonds enables banks to diversify and transfer some of their country exposures to other banks. New market participants in the Brady market include investment banks as well as traditional commercial banks, mutual funds, pension funds, hedge funds, insurance companies, and some retail investors.

Market Transparency

For many instruments, prices are available on standard quote systems such as Bloomberg, Reuters, and Telerate. In addition, many brokers can quote prices on less developed country (LDC) debt instruments. For all but the most liquid Brady bonds and internal debt instruments, however, transparency can be very limited.

PRICING

Pricing for the various LDC issues differs across instruments and countries. The price of a Brady bond is quoted on its spread over U.S. Treasuries. Standard bond pricing models are often used to price the uncollateralized bond and unsecuritized traded bank loans, with emphasis on the credit risk of the issuers (sovereign risk) in determining whether a sufficient risk premium is being paid. Most of the volatility of Brady bonds comes from movement in the spread over U.S. Treasuries.

HEDGING

Over-the-counter (OTC) options are the primary vehicles used to hedge Brady bonds. Because the volume of the OTC options market is approximately one-tenth that of the cash Brady bond market, liquidity is relatively poor.

Cash instruments from the identical sovereign issuer can be used to hedge positions. However, as in other hedging situations, mismatch of terms can lead to basis risk.

Hedging strategies for Brady bonds are often focused on decomposing the sovereign risk from the U.S. rate risk and on neutralizing the latter. For example, a long fixed-coupon Brady bond position is exposed to the risk that U.S. rates will rise and Brady prices will fall. A hedge aimed at immunizing U.S. rate risk can be established with a short U.S. Treasury, Treasury futures, or forward position.

RISKS

Sovereign Risk

One of the most significant risks related to trading of LDC debt is sovereign risk. This includes political, regulatory, economic stability, tax, legal, convertibility, and other forms of risks associated with the country of issuance. Real risk is that of potential controls or taxes on foreign investment. While there is no way to predict policy shifts, it can help to be familiar with any current controls and to closely follow the trend of inflation.

Liquidity Risk

Liquidity risk is the risk that a party may not be able to unwind its position. In emerging markets, liquidity risk can be significant. During the Mexican peso crisis, bids on various instruments were nonexistent. Portfolio values of Latin American instruments plunged. In the OTC market, options are far less liquid than cash bonds. As a result, option positions are often held to expiry rather than traded.

Interest-Rate Risk

Debt issues of various countries are subject to price fluctuations because of changes in sovereign-risk premium in addition to changes in market interest rates and changes in the shape of the yield curve. Spreads between U.S. rates and sovereign rates capture this sovereign-risk premium. In general, the greater the uncertainty of future payoffs, the greater the spread between country rates and U.S. rates. This spread will not necessarily be stable, however, making interest-rate risk *at least* equivalent to that found in U.S. Treasury instruments.

ACCOUNTING TREATMENT

LDC debt that remains in the form of a loan and does not meet the definition of a security in the Financial Accounting Standards Board's Statement of Financial Accounting Standards No. 115 (FAS 115), "Accounting for Certain Investments in Debt and Equity Securities," should be reported and accounted for as a loan. If the loan was restructured in a troubled-debt restructuring involving a modification of terms, and the restructured loan meets the definition of a security in FAS 115, then the instrument should be accounted for according to the provisions of FAS 115.

The accounting treatment for investments in foreign debt is determined by FAS 115, as amended by Statement of Financial Accounting Standards No. 140 (FAS 140), "Accounting for Transfers and Servicing of Financial Assets and Extinguishments of Liabilities." Accounting treatment for derivatives used as investments or for hedging purposes is determined by Statement of Financial Accounting Standards No. 133 (FAS 133), "Accounting for Derivatives and Hedging Activities," as amended by Statement of Financial Accounting Standards Nos. 137 and 138 (FAS 137 and FAS 138). (See section 2120.1, "Accounting," for further discussion.)

RISK-BASED CAPITAL WEIGHTING

Claims that are directly and unconditionally guaranteed by an OECD-based central government or a U.S. government agency are assigned to the zero percent risk category. Claims that are not unconditionally guaranteed are assigned to the 20 percent risk category. A claim is not considered to be unconditionally guaranteed by a central government if the validity of the guarantee depends on some affirmative action by the holder or a third party. Generally, securities guaranteed by the U.S. government or its agencies and securities that are actively traded in financial markets are considered to be unconditionally guaranteed.

Claims on, or guaranteed by, non-OECD central governments that do *not* represent local currency claims that are unconditionally or con-

ditionally guaranteed by non-OECD central governments to the extent that the bank has liabilities booked in that currency are assigned a 100 percent risk weight. Also, all claims on non-OECD state or local governments are assigned to the 100 percent risk category.

LEGAL LIMITATIONS FOR BANK INVESTMENT

Obligations that are guaranteed by a department or an agency of the U.S. government, if the obligation commits the full faith and credit of the United States for the repayment of the obligation, are type I securities and are not subject to investment limitations. Also, obligations guaranteed by the Canadian government are classified as type I securities.

Obligations guaranteed by other OECD countries that are classified as investment grade are type III securities. A bank's investment is limited to 10 percent of its capital and surplus.

Non-investment-grade LDC debt may be purchased under a bank's "reliable estimates" bucket. If a bank concludes, on the basis of reliable estimates, that an obligor will be able to perform, and the security is marketable, it can purchase the security notwithstanding its investment-grade rating. Such securities are subject to a 5 percent limit of a bank's capital and surplus for all securities purchased under this authority.

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GENERAL DESCRIPTION

Foreign exchange (FX) refers to the various businesses involved in the purchase and sale of currencies. This market is among the largest in the world and business is conducted 24 hours a day in most of the financial centers. The major participants are financial institutions, corporations, and investment and speculative entities such as hedge funds. Any financial institution which maintains *due from* bank balances, commonly known as “nostro” accounts, in foreign countries in the local currency can engage in foreign exchange. The volume in this market has been estimated to be the equivalent of \$1 trillion a day.

CHARACTERISTICS AND FEATURES

The FX market is divided into spot, forward, swap, and options segments. Each of these segments is discussed in the following subsections.

Spot

Buying and selling FX at market rates for immediate delivery represents spot trading. Generally, spot trades in foreign currency have a “value date” (maturity or delivery date) of two to five business days (one day for Canada). Foreign-exchange rates that represent the current market value for the currency are known as spot rates. The risk of spot trading results from exchange-rate movements that occur while the financial institution’s position in foreign currency is not balanced with regard to the currency it has bought and sold. Such unbalanced positions are referred to as net open positions.

Net Open Positions

A financial institution has a net open position in a foreign currency when its assets, including spot and forward/futures contracts to purchase, and its liabilities, including spot and forward/futures contracts to sell, in that currency are not equal. An excess of assets over liabilities is called a net “long” position, and liabilities in

excess of assets are called a net “short” position. A long position in a foreign currency which is depreciating will result in an exchange loss relative to book value because, with each day, that position (asset) is convertible into fewer units of local currency. Similarly, a short position in a foreign currency which is appreciating represents an exchange loss relative to book value because, with each day, satisfaction of that position (liability) will cost more units of local currency.

The net open position consists of both balance-sheet accounts and contingent liabilities. For most financial institutions, the *nostro* accounts represent the principal assets; however, foreign-currency loans as well as any other assets or liabilities that are denominated in foreign currency, which are sizeable in certain financial institutions, must be included. All forward/futures foreign-exchange contracts outstanding are contingents. When a contract matures, the entries are posted to a *nostro* account in the appropriate currency.

Each time a financial institution enters into a spot foreign-exchange contract, its net open position is changed. For example, assume that Bank A opens its business day with a balanced net open position in pound sterling (assets plus purchased contracts equal liabilities plus sold contracts). This is often referred to as a “flat” position. Bank A then receives a telephone call from Bank B requesting a “market” in sterling. Because it is a participant in the interbank foreign-exchange trading market, Bank A is a “market maker.” This means it will provide Bank B with a two-sided quote consisting of its bid and offer for sterling. If a different currency was requested, European terms would be the opposite since the bid and offer would be for dollars instead of the foreign currency. In determining the market given, Bank A’s trader of sterling will determine where the market is presently (from brokers and/or other financial institutions), attempt to anticipate where it is headed, and determine whether Bank B is planning to buy or sell sterling.

Forward Transactions

A forward transaction differs from a spot transaction in that the value date is more than two to

five business days in the future. The maturity of a forward foreign-exchange contract can be a few days, months, or even years in some instances. In practice, dates that are two years or more in the future are usually referred to as the long-dated forward market or the long-term FX (LTFX) market. The exchange rate is fixed at the time the transaction is agreed on. However, nostro accounts are not debited or credited, that is, no money actually changes hands, until the maturity date of the contract. There will be a specific exchange rate for each forward maturity, and each of those rates will generally differ from today's spot exchange rate. If the forward exchange rate for a currency is higher than the current spot rate, the currency is trading at a premium for that forward maturity. If the forward rate is below the spot rate, then the currency is trading at a discount. For instance, sterling with a value date of three months is at a discount if the spot rate is \$1.75 and the three-month forward rate is \$1.72.

Foreign-Exchange Swaps

Financial institutions that are active in the foreign-exchange market find that interbank outright forward currency trading is inefficient and engage in it infrequently. Instead, for future maturities, financial institutions trade among themselves as well as with some corporate customers on the basis of a transaction known as a *foreign-exchange swap*. A swap transaction is a simultaneous purchase and sale of a certain amount of foreign currency for two different value dates. The key aspect is that the financial institution arranges the swap as a single transaction with a single counterparty, either another financial institution or a nonbank customer. This means that, unlike outright spot or forward transactions, a trader does not incur a net open position since the financial institution contracts both to pay and to receive the same amount of currency at specified rates. Note that a *foreign-exchange swap* is different from a *foreign-currency swap*, because the currency swap involves the periodic exchange of interest payments. See the discussion in section 4335.1, "Currency Swaps."

A foreign-exchange swap allows each party to use a currency for a period in exchange for another currency that is not needed during that time. Thus, the swap offers a useful investment facility for temporary idle currency balances of

a corporation or a financial institution. Swaps also provide a mechanism for a financial institution to accommodate the outright forward transactions executed with customers or to bridge gaps in the maturity structure of outstanding spot and forward contracts.

The two value dates in a swap transaction can be any two dates. But, in practice, markets exist only for a limited number of standard maturities. One of these standard types is called a *spot-against-forward swap*. In a spot-against-forward swap transaction, a trader buys or sells a currency for the spot value date and simultaneously sells or buys it back for a value date a week, a month, or three months later.

Another type of transaction of particular interest to professional market-making financial institutions is called a *tomorrow-next swap* or a *rollover*. These are transactions in which the dealer buys or sells a currency for value the next business day and simultaneously sells or buys it back for value the day after. A more sophisticated type of swap is called a *forward-forward* in which the dealer buys or sells currency for one future date and sells or buys it back for another future date. Primarily, multinational banks specialize in transactions of this type.

Options

The foreign-exchange options market includes both plain vanilla and exotic transactions. See section 4330.1, "Options," for a general discussion. Most options activity is plain vanilla.

USES

Foreign exchange is used for investment, hedging, and speculative purposes. Most banks use it to service customers and also to trade for their own account. Corporations use the FX market mainly to hedge their foreign-exchange exposure.

DESCRIPTION OF MARKETPLACE

Market Participants

Sell Side

The majority of U.S. banks restrict their foreign-exchange activities to serving their customers'

foreign-currency needs. The banks will simply sell the currency at a rate slightly above the market and subsequently offset the amount and maturity of the transaction through a purchase from another correspondent bank at market rates. This level of activity involves virtually no risk exposure as currency positions are covered within minutes. For these banks, a small profit is usually generated from the rate differential, but the activity is clearly designated as a service center rather than a profit center.

Usually, the larger the financial institution, the greater the emphasis placed on foreign-exchange activity. For instance, while serving the needs of corporate customers is still a priority, most regional banks also participate in the interbank market. These banks may look at the trading function as a profit center as well as a service. Such banks usually employ several experienced traders and may take positions in foreign currencies based on anticipated rate movements. These banks use their involvement in the interbank market to get information about the various markets. For most of these participants, the trading volume in the interbank market constitutes the bulk of the volume. (In some cases, the interbank volume is about 80 to 90 percent of total volume). Multinational banks assume by far the most significant role in the foreign-exchange marketplace. While still serving customer needs, these banks engage heavily in the interbank market and look to their foreign-exchange trading operation for sizeable profits. These banks trade foreign exchange on a global basis through their international branch networks.

One of the major changes in the structure of the foreign-exchange market over the past few years has been the increase in the use of electronic market-making and execution systems. In the past, most interbank dealing was done through the interbank brokers' system; however, advances in technology have made it more efficient for market participants to use electronic systems. (Among the more popular systems are Reuters and EBS (Electronic Brokering Systems).) These developments have decreased the number of errors that are common in the use of the brokers' market (for example, the use of points and error checks) and have also cut down on the costs of doing business.

Buy Side

The buy side consists of corporate hedgers,

investors, and speculators. Corporations use this market to hedge their assets and liabilities incurred as a result of their overseas operations. Investors (for example, international mutual funds) use this market to gain exposure to markets and sometimes to hedge away the currency risk of their equity portfolios.

Market Transparency

Price transparency is very high. The prices for most of the markets are disseminated through various vendors such as Reuters and Telerate.

PRICING

Two methods are used to quote foreign-exchange rates. The method used depends on the currency.

- *American quote.* Number of foreign-currency units per U.S. dollar (for example, 105 yen per dollar). Most currencies are quoted using this convention.
- *European quote.* Number of U.S. dollars per foreign-currency unit (for example, \$1.60 per British pound sterling). British and Irish pounds and Australian and New Zealand dollars are the most common currencies using this convention.

Spot FX

Most institutions will quote both a bid and an offer. When, for example, Bank A quotes sterling at \$1.7115-25, it is saying that it will buy (bid) sterling at \$1.7115 or sell (offer) sterling at \$1.7125. If Bank B's interest is to buy sterling and the given quote is appealing, it will buy sterling from Bank A at \$1.7125 (Bank A's offer price). Note that while Bank B may choose to buy, sell, or pass as it wishes, it must do business on the terms established by Bank A. These terms will be in Bank A's favor. As soon as Bank B announces it will purchase sterling at \$1.7125, Bank A acquires a net open position (short) in sterling. Bank A must then decide whether to hold its short position (in anticipation of a decline in sterling) or cover its position. If it wishes to cover, it may call another bank and purchase the amount it sold to Bank B. However, as the calling bank, Bank A would buy its

sterling from the offered side of the quote it receives and must buy it at \$1.7125 or less to avoid a loss.

Foreign-Exchange Swaps

In foreign-exchange swap transactions, the trader is only interested in the difference between spot and forward rates—the premium or discount—rather than the outright spot and forward rates themselves. Premiums and discounts expressed in points (\$0.0001 per pound sterling or DM 0.0001 per dollar) are called swap rates. If the pound spot rate is \$1.8450 and the six-month forward rate is \$1.8200, the dollar's six-month premium is 250 points (\$0.0250). If the pound spot rate is \$1.8450 and the six-month forward rate is \$1.8625, the dollar's six-month discount is 175 points (\$0.0175).

Since, in a swap transaction, a trader is effectively borrowing one currency and lending the other for the period between the two value dates, the premium or discount is often evaluated in terms of percent per annum. For the examples above, the premium of 250 points is equivalent to 2.71 percent per annum, while the discount of 175 points is equivalent to 1.90 percent per annum. To calculate the percentage premium for the first case—

- take the swap rate (\$0.0250),
- multiply by 12 months and divide by six months (a per annum basis),
- divide by the spot rate (\$1.8450), and
- multiply by 100 (to get a percent basis).

This formula can be expressed as—

$$\% \text{ per annum} = \frac{\text{Premium or Discount} * 12}{\text{Spot rate} * \text{no. of months of forward contract}} * 100$$

Forward rates (premiums or discounts) are solely influenced by the interest-rate differentials between the two countries involved. As a result, when the differential changes, forward contracts previously booked could now be covered at either a profit or loss. For example, assume an interest-rate differential between sterling and dollars of 3 percent (with the sterling rate lower). Using this formula, with a spot rate

of \$1.80, the swap rate on a three-month contract would be a premium of 135 points. If that interest-rate differential increases to 4 percent (by a drop in the sterling rate or an increase in the dollar rate), the premium would increase to 180 points. Therefore, a trader who bought sterling three months forward at 135 points premium could now sell it at 180 points premium, or at a profit of 45 points (expressed as .0045).

Thus, the dealer responsible for forward trading must be able to analyze and project dollar interest rates as well as interest rates for the currency traded. Additionally, because forward premiums or discounts are based on interest-rate differentials, they do not reflect anticipated movements in spot rates.

HEDGING

Spot FX

Banks engaged in trading in the spot market will acquire net open positions in the course of dealing with customers or other market makers. The bank must then decide whether to hold its open position (in anticipation of a move in the currency) or cover its position. If it wishes to cover, the bank may call another bank and either buy or sell the currency needed to close its open position.

Financial institutions engaging in interbank spot trading will often have sizeable net open positions, though many for just brief periods of time. No matter how skilled the trader, each institution will have occasional losses. Knowing when to close a position and take a small loss before it becomes large is a necessary trait for a competent trader. Many financial institutions employ a “stop-loss policy,” whereby a net open position must be covered if losses from it reach a certain level. While a trader's forecast may ultimately prove correct within a day or week, rapid rate movements often cause a loss within an hour or even minutes. Also, access to up-to-the-minute information is vital for involvement in spot trading. Financial institutions that lack the vast informational resources of the largest multinationals may be particularly vulnerable to sudden spot rate movements. As a result, examiners should closely review financial institutions in which foreign-exchange activities consist primarily of interbank spot trading.

Forwards

Active trading financial institutions will generally have a large number of forward contracts outstanding. The portfolio of forward contracts is often called a *forward book*. Trading forward foreign exchange involves projecting interest-rate differentials and managing the forward book to be compatible with these projections.

Forward positions are generally managed on a gap basis. Normally, financial institutions will segment their forward books into 15-day periods and show the net (purchased forward contracts less sold ones) balance for each period. Volumes and net positions are usually segregated into 15-day periods for only the first three months, with the remainder grouped monthly. The trader will use the forward book to manage his or her overall forward positions.

A forward book in an actively traded currency may consist of numerous large contracts but, because of the risks in a net open position, total forward purchases will normally be approximately equal to total forward sales. What matters in reviewing a forward book is the distribution of the positions among periods. For example, if a forward book in sterling has a long net position of 3,200,000 for the first three months and is short a net 3,000,000 for the next four months, the forward book is structured anticipating a decline in dollar interest rates as compared with sterling interest rates since these sold positions could be offset (by purchase of a forward contract to negate the sold forward position) at a lower price—either through reduced premium or increased discount. See the subsection below for a discussion of the risks encountered in hedging foreign-exchange exposure.

RISKS

Exchange-Rate Risk

Exchange-rate (market) risk is an inevitable consequence of trading in a world in which foreign-currency values move up and down in response to shifting market supply and demand. When a financial institution's dealer buys or sells a foreign currency from another financial institution or a nonbank customer, exposure from a net open position is created. Until the time that the position can be covered by selling

or buying an equivalent amount of the same currency, the institution is exposed to the risk that the exchange rate might move against it. That risk exists even if the dealer immediately seeks to cover the position because, in a market in which exchange rates are constantly changing, a gap of just a few minutes can be long enough to transform a potentially profitable transaction into a loss. Since exchange-rate movements can consistently run in one direction, a position carried overnight or over a number of days entails greater risk than one carried a few minutes or hours.

At any time, the trading function of a financial institution may have long positions in some currencies and short positions in others. These positions do not offset each other, even though, in practice, the price changes of some currencies do tend to be correlated. Traders in institutions recognize the possibility that the currencies in which they have long positions may fall in value and the currencies in which they have short positions may rise. Consequently, gross trading exposure is measured by adding the absolute value of each currency position expressed in dollars. The individual currency positions and the gross dealing exposure must be controlled to avoid unacceptable risks.

To accomplish this, management limits the open positions dealers may take in each currency. Practices vary among financial institutions, but, at a minimum, limits are established on the magnitude of open positions which can be carried from one day to the next (overnight limits). Several institutions set separate limits on open positions dealers may take during the day. These are called "daylight limits." Formal limits on gross dealing exposure also are established by some institutions, while others review gross exposure more informally. The various limits may be administered flexibly, but the authority to approve a temporary departure from a limit is typically reserved for a senior officer.

For management and control purposes, most financial institutions distinguish between positions arising from actual foreign-exchange transactions (trading exposure) and the overall foreign-currency-translation exposure of the institution. The former includes the positions recorded by the institution's trading operations at the head office and at offices abroad. In addition to trading exposure, overall exposure incorporates all the institution's assets and liabilities denominated in foreign currencies,

including loans, investments, deposits, and the capital of foreign branches.

Maturity Gaps and Interest-Rate Risk

Interest-rate risk arises whenever mismatches or gaps occur in the maturity structure of a financial institution's foreign-exchange forward book. Managing maturity mismatches is an exacting task for a foreign-exchange trader.

In practice, the problem of handling mismatches is complex. Eliminating maturity gaps on a contract-by-contract basis is impossible for an active trading institution. Its foreign-exchange book may include hundreds of outstanding contracts, with some maturing each business day. Since the book is changing continually as new transactions are made, the maturity gap structure also changes constantly.

While remaining alert to unusually large mismatches in maturities that call for special action, traders generally balance the net daily payments and receipts for each currency through the use of rollovers. Rollovers simplify the handling of the flow of maturing contracts and reduce the number of transactions needed to balance the book. Reliance on day-to-day swaps is a relatively sound procedure as long as interest-rate changes are gradual and the size and length of maturity gaps are controlled. However, it does leave the financial institution exposed to sudden changes in relative interest rates between the United States and other countries. These sudden changes influence market quotations for swap transactions and, consequently, the cost of bridging the maturity gaps in the foreign-exchange book.

The problem of containing interest-rate risk is familiar to major money market banks. Their business often involves borrowing short-term and lending longer-term to benefit from the normal tendency of interest rates to be higher for longer maturities. But in foreign-exchange trading, it is not just the maturity pattern of interest rates for one currency that counts. In handling maturity gaps, the differential between interest rates for two currencies is decisive, making the problem more complex.

To control interest-rate risk, senior management generally imposes limits on the magnitude of mismatches in the foreign-exchange book. Procedures vary, but separate limits are often set on a day-to-day basis for contracts maturing during the following week or two and for each consecutive half-monthly period for contracts

maturing later. At the same time, management relies on officers abroad, domestic money market experts, and its economic research department to provide ongoing analysis of interest-rate trends.

Credit and Settlement Risk

When a financial institution books a foreign-exchange contract, it faces a risk, however small, that the counterparty will not perform according to the terms of the contract. To limit credit risk, a careful evaluation of the creditworthiness of the customer is essential. Just as no financial institution can lend unlimited amounts to a single customer, no institution would want to trade unlimited amounts of foreign exchange with one counterparty.

Credit risk arises whenever an institution's counterparty is unable or unwilling to fulfill its contractual obligations—most blatantly when a corporate customer enters bankruptcy or an institution's counterparty is declared insolvent. In any foreign-exchange transaction, each counterparty agrees to deliver a certain amount of currency to the other on a particular date. Every contract is immediately entered into the financial institution's foreign-exchange book. In balancing its trading position, a financial institution counts on that contract being carried out in accordance with the agreed-upon terms. If the contract is not liquidated, then the institution's position is unbalanced and the institution is exposed to the risk of changes in the exchange rates. To put itself in the same position it would have been in if the contract had been performed, an institution must arrange for a new transaction. The new transaction may have to be arranged at an adverse exchange rate. The trustee for a bankrupt company may perform only on contracts which are advantageous to the company and disclaim those contracts which are disadvantageous. Some dealers have attempted to forestall such arbitrary treatment through the execution of legally recognized bilateral netting agreements. Examiners should determine whether dealers have such agreements in place and whether they have a favorable legal opinion as to their effectiveness, particularly in cross-border situations.

Another form of credit and settlement risk stems from the time-zone differences between the United States and foreign nations. Inevitably, an institution selling sterling, for instance,

must pay pounds to a counterparty before it will be credited with dollars in New York. In the intervening hours, a company can go into bankruptcy or an institution can be declared insolvent. Thus, the dollars may never be credited. Settlement risk has become a major source of concern to various supervisory authorities because many institutions are not aware of the extent of the risks involved. The Bank for International Settlements (BIS) has laid out the various risks in a paper that was published in July 1996.

Managing credit risk is the joint responsibility of the financial institution's trading department and its credit officers. A financial institution normally deals with corporations and other institutions with which it has an established relationship. Dealing limits are set for each counterparty and are adjusted in response to changes in its financial condition. In addition, most institutions set separate limits on the value of contracts that can mature on a single day with a particular customer. Some institutions, recognizing that credit risk increases as maturities lengthen, restrict dealings with certain customers to spot transactions or require compensating balances on forward transactions. An institution's procedures for evaluating credit risk and minimizing exposure are reviewed by supervisory authorities as part of the regular examination process.

ACCOUNTING TREATMENT

The accounting treatment for foreign-exchange contracts is determined by the Financial Accounting Standards Board's Statement of Financial Accounting Standards No. 133 (FAS 133), "Accounting for Derivatives and Hedging Activities," as amended by Statement of Financial Accounting Standards Nos. 137 and 138 (FAS 137 and FAS 138). (See section 2120.1, "Accounting," for further discussion.)

RISK-BASED CAPITAL WEIGHTING

The credit-equivalent amount of a foreign-exchange contract is calculated by summing—

1. the mark-to-market value (positive values only) of the contract and
2. an estimate of the potential future credit exposure over the remaining life of each contract.

The conversion factors are as follows.

<i>Remaining maturity</i>	<i>Credit-conversion factor</i>
One year or less	1.00%
Five years or less	5.00%
Greater than five years	7.50%

If a bank has multiple contracts with a counterparty and a qualifying bilateral contract with the counterparty, the bank may establish its current and potential credit exposures as net credit exposures. (See section 2110.1, "Capital Adequacy.") For institutions that apply market-risk capital standards, all foreign-exchange transactions are included in value-at-risk (VAR) calculations for market risk.

LEGAL LIMITATIONS FOR BANK INVESTMENT

Foreign-exchange contracts are not considered investment securities under 12 USC 24 (seventh). However, the use of these instruments is considered to be an activity incidental to banking, within safe and sound banking practices.

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- Das, Satyajit. *Swap and Derivative Financing*. Chicago: Probus Publishing, 1993.
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GENERAL DESCRIPTION

Forwards are financial contracts in which two counterparties agree to exchange a specified amount of a designated product for a specified price on a specified future date or dates. Banks are active participants in the forward market. Forwards differ from futures (discussed separately in this manual) in that their terms are not standardized and they are not traded on organized exchanges. Because they are individually negotiated between counterparties, forwards can be customized to meet the specific needs of the contracting parties.

CHARACTERISTICS AND FEATURES

Forwards are over-the-counter (OTC) contracts in which a buyer agrees to purchase from a seller a specified product at a specified price for delivery at a specified future time. While forward contracts can be arranged for almost any product, they are most commonly used with currencies, securities, commodities, and short-term debt instruments. (Forwards on short-term debt instruments, or “forward rate agreements,” are discussed separately in this manual.) Commitments to purchase a product are called long positions, and commitments to sell a product are called short positions.

Foreign-exchange forward contracts constitute the largest portion of the forward market. They are available daily in the major currencies in 30-, 90-, and 180-day maturities, as well as other maturities depending on customer needs. Contract terms specify a forward exchange rate, a term, an amount, the “value date” (the day the forward contract expires), and locations for payment and delivery. The date on which the currency is actually exchanged, the “settlement date,” is generally two days after the value date of the contract.

In most instances, foreign-exchange forwards settle at maturity with cash payments by each counterparty. Payments between financial institutions arising from contracts that mature on the same day are often settled with one net payment.

USES

Market participants use forwards to (1) hedge market risks, (2) arbitrage price discrepancies within and between markets, (3) take positions on future market movements, and (4) profit by acting as market makers. Financial institutions, money managers, corporations, and traders use these instruments for managing interest-rate, currency, commodity, and equity risks. While most large financial institutions are active in the interest-rate and foreign-exchange markets, only a handful of financial institutions have exposures in commodities or equities.

Hedging Interest-Rate Exposure

Financial institutions use forwards to manage the risk of their assets and liabilities, as well as off-balance-sheet exposures. Asset-liability management may involve the use of financial forwards to lock in spreads between borrowing and lending rates. For example, a financial institution may sell an interest-rate forward contract in advance of an anticipated funding to lock in the cost of funds. If LIBOR subsequently increases, the short position will increase in value, offsetting the higher spot interest cost that the financial institution will have to pay on its funding.

Forward contracts may be used to hedge investment portfolios against yield curve shifts. Financial institutions can hedge mortgage portfolios by selling GNMA forwards, and government bond dealers may sell forwards to hedge their inventory. Pension and other types of benefits managers may hedge a fixed future liability by selling forwards or may hedge an expected receipt by buying forwards. When offsetting swaps with the necessary terms cannot be found, interest-rate swap dealers may also use forwards, as well as Eurodollar futures and Treasury futures, to hedge their unmatched commitments.

Hedging Foreign-Exchange Exposure

Corporations engaged in international trade may use foreign-currency contracts to hedge payments and receipts denominated in foreign currencies. For example, a U.S. corporation that

exports to Germany and expects payment in deutschemarks (DM) could sell DM forwards to eliminate the risk of a depreciation of the DM at the time that the payment arrives. A corporation may also use foreign-exchange contracts to hedge the translation of its foreign earnings for presentation in its financial statements.

Financial institutions use foreign-exchange forwards to hedge positions arising from their foreign-exchange dealing businesses. An institution that incurs foreign-exchange exposure from assisting its customers with currency risk management can use offsetting contracts to reduce its own exposure. A financial institution can also use forwards to cover unmatched currency swaps. For example, a dealer obligated to make a series of DM payments could buy a series of DM forwards to reduce its exposure to changes in the DM/\$ exchange rate.

Arbitrage

Risk-free arbitrage opportunities in which a trader can exploit mispricing across related markets to lock in a profit are rare. However, for brief periods of time, pricing in the forward market may not be consistent with pricing in the cash market. For example, if DM forwards are overpriced relative to the rates implied by interest-rate parity relationships, a trader could borrow dollars, sell them against spot DM, purchase a DM deposit, and sell the DM forward. This arrangement would lock in a risk-free return.

DESCRIPTION OF MARKETPLACE

Primary Market

Forward contracts are not standardized. Market makers such as banks, investment banks, and some insurance companies arrange forward contracts in various amounts, including odd lots, to suit the needs of a particular counterparty. Brokers, who arrange forward contracts between two counterparties for a fee, are also active in the forward market. End-users, including banks, corporations, money managers, and sovereign institutions, use forwards for hedging and speculative purposes.

Secondary Market

Once opened, forwards tend not to trade because of their lack of standardization, the presence of counterparty credit risk, and their limited transferability.

Market Transparency

The depth of the interest-rate and foreign-exchange markets and the interest-rate parity relationships help ensure transparency of forward prices. Market makers quote bid/ask spreads, and brokers bring together buyers and sellers, who may be either dealers or end-users. Brokers distribute price information over the phone and via electronic information systems.

PRICING

In general, the value of a long forward contract position equals the spot price minus the contract price. For example, forward (and spot) foreign-exchange rates are quoted in the number of units of the foreign currency per unit of the domestic currency. Forward foreign-exchange rates depend on interest-rate parity among currencies. Interest-rate parity requires the forward rate to be that rate which makes a domestic investor indifferent to investing in the home currency versus buying foreign currency at the spot rate, investing it in a foreign time deposit, and subsequently converting it back to domestic currency at the forward rate. The interest-rate parity relationship can be expressed as—

$$F = S \times [1 + r(F)] / [1 + r(D)],$$

where F is the forward rate, S is the spot rate, $r(D)$ is the domestic interest rate, and $r(F)$ is the foreign interest rate. Currency rates are foreign currency per unit of domestic currency. For example, assume the 180-day dollar (\$) interest rate is 5 percent, the 180-day DM interest rate is 10 percent, and the DM/\$ spot rate is 1.3514 (DM per dollar). A dollar-based investor can borrow dollars at 5 percent, sell them against DM at the DM/\$ spot rate of 1.3514, and invest the DM at a 10 percent rate of return. When the investment matures, the DM proceeds can be reconverted to dollars at the forward rate of 1.4156 DM for each dollar, giving the investor a total dollar return of 5 percent, which is the

same return available in dollar deposits. In this instance, the forward rate is higher than the spot rate to compensate for the difference between DM- and dollar-based interest rates. The difference between the domestic and foreign interest rates is referred to as the “cost of carry.”

HEDGING

Positions in forwards can be offset by cash-market positions as well as by other forward or futures positions. A financial institution’s exposure from a foreign-exchange forward contract can be split into a spot-currency component and an interest-rate differential between the two currencies. For the spot foreign-exchange component, consider a three-month long forward position that receives sterling (£) and pays dollars (in three months, the institution receives sterling and pays dollars). This position is comparable to the combination of receiving a three-month dollar deposit and making a three-month sterling loan. The forward position implicitly locks in a spread between the lending and borrowing rates while exposing the institution to future sterling-dollar spot rates.

To eliminate the currency and interest-rate exposure, the financial institution can either enter into an offsetting forward or take a short position in sterling. By entering into a three-month forward contract to deliver sterling against dollars, the financial institution could virtually eliminate its currency exposure. Alternatively, the institution could borrow three-month sterling, sell it, and invest the dollar proceeds in a three-month deposit. When the long sterling-dollar forward comes due, the institution can use the maturing dollar deposit to make its payment and apply the sterling proceeds to the repayment of the sterling loan.

RISKS

Users and providers of forwards face various risks, which must be well understood and carefully managed. The risk-management methods applied to forwards and futures may be similar to those used for other derivative products.

Credit Risk

Generally, a party to a forward contract faces credit risk to the degree that its side of the

contract has positive market value. In other words, credit risk in forwards arises from the possibility that a contract has a positive replacement cost and the counterparty to the contract fails to perform its obligations. The value of a contract is generally zero at inception, but it changes as the market price of the product underlying the forward changes. If the institution holds a contract that has a positive market value (positive replacement cost) and if the counterparty defaults on the contract, the institution would forfeit this value. To counter this risk, weak counterparties may be required to collateralize their commitments. Counterparties dealing with financial institutions may be required to maintain compensating balances or collateral. Because of their credit risk and the lack of standardization, forwards generally cannot be terminated or transferred without the consent of each party.

As part of their risk management, financial institutions generally establish credit lines for each trading counterparty. For foreign exchange (spot and forward), the lines are most often expressed in notional terms. These credit lines include global counterparty limits, daily counterparty settlement limits, and maturity limits. Some sophisticated financial institutions use credit-equivalent risk limits rather than notional amounts for their foreign-exchange exposure. For interest-rate risk, financial institutions usually express their exposure in credit equivalents of notional exposure. Financial institutions may require a less creditworthy counterparty to pledge collateral and supplement it if the position moves against the counterparty.

Market Risk

The risk of forward contracts should be evaluated by their effect on the market risk of the overall portfolio. Institutions that leave positions in the portfolio unhedged may be more exposed to market risk than institutions that “run a matched book.” A financial institution may choose to leave a portion of its exposure uncovered to benefit from expected price changes in the market. However, if the market moves against the institution’s prediction, the institution would incur losses.

Basis Risk

Basis risk is the potential for loss from changes

in the price or yield differential between instruments in two markets. Although risk from changes in the basis tends to be less than that arising from absolute price movements, it can sometimes represent a substantial source of risk. Investors may set up hedges, which leave them vulnerable to changes in basis between the hedge and the hedged instrument.

Yield-curve risk may also arise from holding long and short positions with equal durations but different maturities. Although such arrangements may protect against a parallel yield-curve shift, they may leave investors exposed to the risk of a nonparallel shift causing uneven price changes. In foreign currency, basis risk arises from changes in the differential between interest rates of two currencies.

Liquidity Risk

Forwards are usually not transferable without the consent of the counterparty and may be harder to liquidate than futures. To eliminate the exposure of a contract, a customer may have to buy an offsetting position if the initial dealer does not want to unwind or allow the transfer of the contract.

Clearing and Settlement Risk

In OTC markets, clearing and settlement occur on a bilateral basis thereby exposing counterparties to intraday and overnight credit risks. To reduce these risks and transactions costs, many financial institutions have bilateral netting arrangements with their major counterparties. Position netting allows counterparties to net their payments on a given day but does not discharge their original legal obligations for the gross amounts. Netting by novation replaces obligations under individual contracts with a single new obligation.

ACCOUNTING TREATMENT

The accounting treatment for foreign-exchange forward contracts is determined by the Financial Accounting Standards Board's Statement of Financial Accounting Standards No. 133 (FAS 133), "Accounting for Derivatives and Hedging Activities," as amended by Statement of Financial Accounting Standards Nos. 137 and 138

(FAS 137 and FAS 138). (See section 2120.1, "Accounting," for further discussion.)

RISK-BASED CAPITAL WEIGHTING

The credit-equivalent amount of a forward contract is calculated by summing—

1. the mark-to-market value (positive values only) of the contract and
2. an estimate of the potential future credit exposure over the remaining life of each contract.

The conversion factors are below.

<i>Remaining maturity</i>	<i>Credit-conversion factor</i>
One year or less	0.00%
Five years or less	0.50%
Greater than five years	1.50%

If a bank has multiple contracts with a counterparty and a qualifying bilateral contract with the counterparty, the bank may establish its current and potential credit exposures as net credit exposures. (See section 2110.1, "Capital Adequacy.") For institutions that apply market-risk capital standards, all foreign-exchange transactions are included in value-at-risk (VAR) calculations for market risk.

LEGAL LIMITATIONS FOR BANK INVESTMENT

Forwards are not considered investments under 12 USC 24 (seventh). The use of these instruments is considered to be an activity incidental to banking, within safe and sound banking practices.

REFERENCES

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- Beidleman, Carl. *Financial Swaps*. Dow Jones-Irwin, 1985.
- Hull, John C. *Options, Futures and Other Derivative Securities*. 2d ed. Prentice Hall, 1989.

GENERAL DESCRIPTION

A forward rate agreement (FRA) is an over-the-counter (OTC) contract for a cash payment at maturity based on a *market (spot) rate* and a prespecified *forward rate*. The contract specifies how the spot rate is to be determined (this is sometimes called the *reference rate*). If the spot rate is higher than the contracted rate, the seller agrees to pay the buyer the difference between the prespecified forward rate and the spot rate prevailing at maturity, multiplied by a *notional principal amount*. If the spot rate is lower than the forward rate, the buyer pays the seller. The notional principal, which is not exchanged, represents a Eurocurrency deposit of a specified *maturity or tenor*, which starts on the day the FRA matures. The cash payment is the present value of the difference between the forward rate and the spot rate prevailing at the settlement date times the notional amount. This payment is due at the settlement date. Buying and selling FRAs is sometimes called *taking* and *placing* FRAs, respectively. FRAs with maturities longer than a year are called *long-dated* FRAs.

FRAs are usually *settled* at the start of the agreed-upon period in the future. At this time, payment is made of the discounted present value of the interest payment corresponding to the difference between the contracted fixed rate (the forward rate at origination) and the prevailing reference rate (the spot rate at maturity). For example, in a six-against-nine-month (6x9) FRA, the parties agree to a three-month rate that is to be netted in six months' time against the prevailing three-month reference rate, typically LIBOR. At settlement (after six months), the present value of the net interest rate (the difference between the spot and the contracted rate) is multiplied by the notional principal amount to determine the amount of the cash exchanged between the parties. The basis used in discounting is actual/360-day for all currencies except pounds sterling, which uses an actual/365-day count convention.

CHARACTERISTICS AND FEATURES

An FRA can be entered into either orally or in writing. Each party is, however, required to

confirm the FRA in writing. FRAs are customized to meet the specific needs of both parties. They are denominated in a variety of currencies and can have customized notional principal amounts, maturities, and interest periods. The British Bankers' Association (BBA) has developed standards for FRAs, called *Forward Rate Agreements of the BBA (FRABBA) terms*, which are widely used by brokers and dealers. The standards include definitions, payment and confirmation practices, and various rights and remedies in case of default. Under these standards, counterparties execute a master agreement, under which they agree to execute their FRA transactions.

USES

Hedging

FRAs are often used as a hedge against future movement in interest rates. Like financial futures, they offer a means of managing interest-rate risk that is not reflected on the balance sheet and, therefore, generally requires less capital.

FRAs allow a borrower or lender to "lock in" an interest rate for a period that begins in the future (assuming no change in the basis), thus effectively extending the maturity of its liabilities or assets. For example, a financial institution that has limited access to funds with maturities greater than six months and has relatively longer-term assets can contract for a six-against-twelve-month FRA, and thus increase the extent to which it can match asset and liability maturities from an interest-rate risk perspective. By using this strategy, the financial institution determines today the cost of six-month funds it will receive in six months' time. Similarly, a seller of an FRA can lengthen the maturity profile of its assets by determining in advance the return on a future investment.

Trading

Banks and other large financial institutions employ FRAs as a trading instrument. Market makers seek to earn the bid/ask spread through buying and selling FRAs. Trading may also take the form of arbitrage between FRAs and interest-rate futures or short-term interest-rate swaps.

DESCRIPTION OF MARKETPLACE

Primary Market

Commercial banks are the dominant player in the FRA market, both as market makers and end-users. Nonfinancial corporations have also become significant users of FRAs for hedging purposes. Most contracts are originated in London and New York, but all major European financial centers have a significant share of volume. Market transparency is high in the FRA market, and quotes for standard FRA maturities in most currencies can be obtained from sources such as Telerate and Bloomberg.

A significant amount of trading in FRAs is done through brokers who operate worldwide. The brokers in FRAs usually deal in Euros and swaps. The principal brokers are Tullet & Tokyo Foreign Exchange; Garvin Guy Butler; Godsell, Astley & Pearce; Fulton Prebon; and Eurobrokers.

Secondary Market

The selling of an existing FRA consists of entering into an equal and opposite FRA at a forward rate offered by a dealer or other party at the time of the sale. The secondary market in FRAs is very active and is characterized by a significant amount of liquidity and market transparency.

PRICING

Initial Cost

When an FRA is initiated, the FRA *rate* is set such that the value of the contract is zero, since no money is exchanged, except perhaps a small arrangement fee (which may not be payable until settlement). Forward rates are directly determined from spot rates. For example, the rate on a 6-against-12-month FRA will be derived directly from rates on 6- and 12-month deposits. (This rate derived from the yield curve is termed an *implied forward rate*.) As an example, suppose the 6-month Eurodollar deposit rate is 6.00 percent and the 12-month Eurodollar deposit rate is 7.00 percent. The rate on a 6-against-12-month FRA would be derived by finding the 6-month forward rate, 6 months hence (${}_6R_{12}$):

$$(1.07) = (1.06)^5(1 + {}_6R_{12})^5$$

$${}_6R_{12} = 8.00\%$$

There is little evidence that arbitrage opportunities exist between the FRA and deposit markets after taking into account bid/offer spread and transactions costs.

Valuation at Settlement

Settlement on an FRA contract is made in advance, that is at the settlement date of the contract. The settlement sum is calculated by discounting the interest differential due from the maturity date to the settlement date using the relevant market rate.

Let f = the FRA rate (as a decimal), s = the spot rate at maturity (as a decimal), t = the tenor of the notional principal in number of days, P = the notional principal, and V = the sum due at settlement. Assume that the basis is actual/360-day. The interest due the buyer before discounting is $(s - f)P(t/360)$. The discount factor is $1 - s(t/360)$. V is the sum due at settlement:

$$V = [(s - f)P(t/360)][1 - s(t/360)]$$

For example, consider a \$10 million three-against-six-month FRA with a forward rate of 6.00 percent and a spot rate at maturity of 6.50 percent.

$$V = [\$10\text{mm}(.065 - .06)(91/360)] \\ [1 - ((.065)(91/360))]$$

$$V = \$12,431.22$$

A payment of \$12,431.22 would be made by the seller to the buyer of the FRA at settlement.

HEDGING

Market Risk

Eurodollar futures are usually used to hedge the market risk of FRA positions. However, the only perfect economic hedge for an FRA is an offsetting FRA with the same terms.

Credit Risk

Letters of credit, collateral, and other credit

enhancements can be required to mitigate the credit risks of FRAs. In practice, however, this is rarely done because the credit risk of FRAs is very low.

RISKS

Interest-Rate Risk

The interest-rate risk (or market risk) of an FRA is very similar to a short-term debt instrument whose maturity is equal to the interest period of the FRA. For example, a six-against-nine-month FRA has a price sensitivity similar to that of a three-month debt instrument (approximate duration of one-fourth of a year).

Liquidity Risk

Liquidity risk (the likelihood that one cannot close out a position) is low. The FRA markets are very liquid, although generally not as liquid as the futures markets.

Credit Risk

The credit risk of FRAs is small but greater than the credit risk of futures contracts. The credit risk of futures is minimal because of daily margining and the risk management of the futures clearing organizations. If an FRA counterparty fails, a financial institution faces a loss equal to the contract's replacement cost. The risk of loss depends on both the likelihood of an adverse movement of interest rates and the likelihood of default by the counterparty. For example, suppose a financial institution buys an FRA at 10 percent to protect itself against a rise in LIBOR. By the settlement date, LIBOR has risen to 12 percent, but the counterparty defaults. The financial institution therefore fails to receive anticipated compensation of 2 percent per year of the agreed notional principal amount for the period covered by the FRA. Note that the financial institution is not at risk for the entire notional principal amount but only for the net interest-rate differential.

FRAs raise the same issues about measuring credit-risk exposure as interest-rate swaps. Because the periods covered by FRAs are typically much shorter, many institutions calculate the credit exposure on FRAs as a flat rate against the counterparty's credit limit, for example,

5 percent (sometimes 10 percent) of the notional principal amount. The 5 percent credit exposure is a rule of thumb adopted for administrative ease, and it represents the approximate potential loss from counterparty default if the reference interest rate for a three-month future period moves against the financial institution by 20 percentage points before the settlement date. For an agreement covering a six-month future interval, the 5 percent charge to a counterparty's credit limit represents exposure against approximately a 10 percentage point movement in the reference interest rate.

ACCOUNTING TREATMENT

The accounting treatment of single-currency forward interest-rate contracts, such as forward rate agreements, is determined by the Financial Accounting Standards Board's Statement of Financial Accounting Standards No. 133 (FAS 133), "Accounting for Derivatives and Hedging Activities," as amended by Statement of Financial Accounting Standards Nos. 137 and 138 (FAS 137 and FAS 138). (See section 2120.1, "Accounting," for further discussion.)

RISK-BASED CAPITAL WEIGHTING

The credit-equivalent amount of an FRA contract is calculated by summing—

1. the mark-to-market value (positive values only) of the contract and
2. an estimate of the potential future credit exposure over the remaining life of each contract.

The conversion factors are below.

<i>Remaining maturity</i>	<i>Credit-conversion factor</i>
One year or less	0.00%
Five years or less	0.50%
Greater than five years	1.50%

If a bank has multiple contracts with a counterparty and a qualifying bilateral contract with the counterparty, the bank may establish its current and potential credit exposures as net credit exposures. (See section 2110.1, "Capital

Adequacy.”) For institutions that apply market-risk capital standards, all foreign-exchange transactions are included in value-at-risk (VAR) calculations for market risk.

LEGAL LIMITATIONS FOR BANK INVESTMENT

FRAs are not considered investments under 12 USC 24 (seventh). The use of these instruments is considered to be an activity incidental to banking, within safe and sound banking practices.

REFERENCES

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- Francis, Jack, and Avner Wolf. *The Handbook of Interest Rate Risk Management*. Irwin Professional Publishing, 1994.
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GENERAL DESCRIPTION

Futures contracts are exchange-traded agreements for delivery of a specified amount and quality of a particular product at a specified price on a specified date. Futures contracts are essentially exchange-traded forward contracts with standardized terms. Futures exchanges establish standardized terms for futures contracts so that buyers and sellers only have to agree on price.

Unlike the over-the-counter (OTC) derivative markets, futures contracts are required by U.S. law to trade on federally licensed contract markets that are regulated by the Commodity Futures Trading Commission (CFTC). Banks may invest in futures for their own account or act as a futures broker through a futures commission merchant (FCM) subsidiary. The two generic types of futures contracts are commodity futures (such as coffee, cocoa, grain, or rubber) and financial futures (that is, currencies, interest rates, and stock indexes). This section focuses on financial futures.

CHARACTERISTICS AND FEATURES

Terms

All futures contracts have the following standardized terms: specific product, quality (or grade), contract size, pricing convention, and delivery date. The following is an example of the terms on a futures contract for U.S. Treasury notes traded on an exchange such as the Chicago Board of Trade (CBOT).

Product:	10-year Treasury notes
Contract size:	\$100,000
Price quoted:	32nds of 100 percent
Delivery date:	Any business day of delivery month (March, June, September, or December, depending on the particular contract)
Deliverable grade:	Any U.S. Treasury notes with maturity of 6½ to 10 years

Margin

In addition, all exchanges require a *good faith* deposit or *margin* in order to buy or sell a futures contract. The amount of margin will vary from contract to contract and from exchange to exchange. The required margin deposit may also vary depending on the type of position held. The margin requirement is meant to ensure that adequate funds are available to cover losses in the event of adverse price changes. Margin requirements are determined and administered by the exchange's clearinghouse.

As an example of how margin requirements operate, consider a deutschemark (DM) 125,000 futures contract against the dollar with a price of \$.68/DM. One trader takes a long DM position, meaning that it will receive DM 125,000 and pay \$85,000 in December. Another trader takes a short DM position, such that it will pay the DM 125,000 in return for \$85,000. Each trader puts up an initial margin of \$4,250, which is invested in U.S. Treasuries in margin accounts held at each trader's broker. Time passes and the \$/DM rate increases (the DM decreases in value) so that the trader with the long DM position must post additional margin. When the spot rate subsequently reaches \$.61/DM, the long trader decides to cut his losses and close out his position. Ignoring the limited effect of prior fluctuations in margin, the long trader's cumulative loss measures \$8,750 ($$.68/\text{DM} - $.61/\text{DM} \times \text{DM } 125,000$).

Exchanges

Futures contracts are traded on organized exchanges around the world. Exchanges for the major futures contracts in currencies, interest rates, and stock indexes are discussed below.

Currency Futures

In the United States, futures contracts trade in the International Monetary Market (IMM) of the Chicago Mercantile Exchange (CME) in the major currencies, including the deutschemark, Japanese yen, British pound, Canadian dollar, and Swiss franc. Overseas, the most active currency futures exchanges are the London

International Financial Futures Exchange (LIFFE) and the Singapore International Monetary Exchange (SIMEX).

Interest-Rate Futures

The IMM and the CBOT list most of the fixed-income futures in the United States. Contracts on longer-term instruments, such as Treasury notes (2-, 5-, and 10-year) and Treasury bonds (30-year), are listed on the CBOT. Futures on short-term instruments such as Eurodollar deposits and Treasury bills trade on the IMM. There are also futures on bond indexes such as those for municipal bonds, corporate bonds, Japanese government bonds, and British gilts. As with currencies, the most active overseas exchanges are in London and Singapore.

Stock-Index Futures

In the United States, stock-index futures are available for the S&P 500 (CME), Major Market Index (CME), New York Stock Exchange Composite Index (New York Futures Exchange), and Nikkei 225 Index (CME). Overseas, there are futures on many of the major equity markets, including the Nikkei (Osaka and Singapore Futures Exchanges), DAX (LIFFE), and FTSE 100 (LIFFE).

Clearinghouses

Clearinghouses provide centralized, multilateral netting of an exchange's futures contracts. Centralized clearing, margin requirements, and daily settlement of futures contracts substantially reduce counterparty credit risk. A futures exchange operates in tandem with a clearinghouse that interposes itself between a contract's counterparties and, thus, guarantees payment to each.

In addition, customers in futures markets post collateral, known as initial margin, to guarantee their performance on the obligation. At the end of each day, the futures position is marked to market with gains paid to or losses deducted from (variation margin payments) the margin account. The balance in a margin account cannot fall below a minimum level (known as maintenance margin). If the position falls below the

maintenance margin, the counterparty must put up additional collateral.

Under some circumstances, traders that have positions in a variety of futures and options on futures can have their margin determined on a portfolio basis. This process takes into account the natural offsets from combinations of positions which may reduce the total margin required of a market participant. The industry has developed a scenario-based portfolio margining system called SPARTM which stands for the Standard Portfolio Analysis of Risk.

Many futures contracts specify settlement in cash, rather than by physical delivery, upon expiration of the contract. Cash settlement has the advantage of eliminating the transaction costs of purchasing and delivering the underlying instruments. Examples of cash-settled contracts are futures on Eurodollars, municipal bond indexes, and equity indexes.

USES

Market participants use futures to (1) hedge market risks, (2) arbitrage price discrepancies within and between markets, (3) take positions on future market movements, and (4) profit by acting as market makers (forwards) or brokers (futures). Financial institutions, money managers, corporations, and traders use these instruments for managing interest-rate, currency, commodity, and equity risks. While most large financial institutions are active in the interest-rate and foreign-exchange markets, only a handful of financial institutions have exposures in commodities or equities.

Hedging

Futures are used to hedge the market risk of an underlying instrument. For example, financial institutions often face interest-rate risk from borrowing short-term and lending long-term. If rates rise, the institution's spread will decrease or even become negative. The institution can hedge this risk by shorting a futures contract on a fixed-income instrument (such as a Treasury security) maturing at the same time as the asset. If rates rise, the futures position will increase in value, providing profit to offset the decrease in net interest spread on the cash position. If rates fall, however, the value of the futures contract

will fall, offsetting the increase in the institution's interest-rate spread.

Arbitrage

Risk-free arbitrage opportunities in which a trader can exploit mispricing across related markets to lock in a profit are rare. For brief periods of time, pricing in the futures market may be inconsistent with pricing in the cash market. For example, if DM futures are overpriced relative to the rates implied by interest-rate parity relationships, a trader could borrow dollars, sell them against spot DM, purchase a DM deposit, and sell the DM future. This arrangement would lock in a risk-free return.

Positioning

Traders and investors can use futures for speculating on price movements in various markets. Futures have the advantage of lower transactions costs and greater leverage than many cash-market positions. Speculators may make bets on changes in futures prices by having uncovered long or short positions, combinations of long and short positions, combinations of various maturities, or cash and futures positions. Speculators may profit from uneven shifts in the yield curve, fluctuations in exchange rates, or changes in interest-rate differentials.

For example, a speculator expecting stock prices to increase buys 10 contracts on the S&P 500 index for March delivery at a price of \$420. Each contract covers 500 times the price of the index, thereby giving the speculator immediate control of over \$2.1 million ($420 \times 500 \times 10$) of stock. By February, the index increases to 440, giving the speculator an unrealized profit of \$100,000 ($(440 - 420) \times 500 \times 10$). The market is still bullish, so the speculator decides to hold the contract for several more weeks, anticipating more profits. Instead, negative economic news drives the index down to 405 and induces the speculator to close out his position, leaving a loss of \$75,000.

Money managers use financial futures as an asset-allocation tool. Futures allow managers to shift the fixed-income, currency, and equity portions of their portfolios without having to incur the costs of transacting in the cash market. A fixed-income manager may use bond futures

to readjust the composition of a fixed-income portfolio in response to a particular outlook on interest rates. For example, a manager anticipating an increase in interest rates can shorten portfolio duration to reduce the risk of loss by selling Treasury bond or bill futures. Currency futures could be used to reduce or increase currency risk in an international portfolio. Equity index futures can be used to adjust a portfolio's exposure to the stock market.

Market Making or Brokering

A financial institution can also attempt to profit by holding itself out as a market maker or broker, providing two-way prices (bid and offer) to the market. While earning the bid offer spread, the institution will either hedge the resulting positions or choose to hold the position to speculate on expected price movements.

DESCRIPTION OF MARKETPLACE

The combination of contract standardization, centralized clearing, and limited credit risk promotes trading of futures on exchanges such as the CBOT, CME, and LIFFE. In the United States, futures exchanges traditionally use the "open outcry" method of trading, whereby traders and floor brokers, standing in pits on the trading floor, shout out or use hand signals to indicate their buy and sell orders and prices. Technological innovation and the desire for after-hours trading have fostered the development of electronic trading systems. These systems have become quite popular overseas, especially on newer exchanges. For example, GLOBEX is an electronic trading system that currently provides after-hours trading of contracts listed on the CME and the MATIF (Marche a Terme International de France) in Paris. The LIFFE after-hours trade-matching system is called APT, and the CBOT system is called Project A. In addition to these electronic trading systems, several exchanges have extended trading hours through exchange linkages. The oldest and most well-known linkage is the mutual offset system between the CME and the SIMEX for Eurodollar futures contracts. SIMEX has similar arrangements with the International Petroleum Exchange (IPE). LIFFE has announced

plans for futures linkages with the CBOT and the CME.

Customers submit their buy or sell orders through registered commodity brokers known as FCMs. Several large domestic and foreign banks and bank holding companies have established their own FCM subsidiaries. Most of these subsidiaries are also clearing members of the major commodity exchange clearinghouses and have an established floor staff working on the clearinghouse's associated futures exchange. Institutional customers often place their orders directly with the FCM's phone clerks on the exchange floor. The clerk signals the order to a pit broker (usually an independent contractor of the FCM). The pit broker completes the transaction with another member of the exchange and then signals a confirmation back to the phone clerk who verbally relates the trade information back to the customer. The trade is then processed by the FCM for trade matching, clearing, and settlement. An FCM's back-office clerks usually recap the customer's transactions at the end of day with the customer's back-office staff. Paper confirmation is mailed out the following day; however, on-line confirmation capability is becoming increasingly common.

PRICING

As with forward rates, futures prices are derived from arbitrage-free relationships with spot prices, taking into account carrying costs for corresponding cash-market goods. With commodities, carrying costs include storage, insurance, transportation, and financing costs. The cost-of-carry for financial instruments consists mostly of financing costs, though it may also include some fixed costs such as custody fees. The cost-of-carry concept when referred to in the context of futures contracts is known as the *basis* (that is, the difference between the cash price for a commodity or instrument and its corresponding futures price).

In the case of fixed-income, interest-rate futures, the cost-of-carry represents the difference between the risk-free, short-term interest rate and the yield on the underlying instrument. The price of a fixed-income future can be expressed by the formula:

$$F = P + [P \times (r - y)],$$

where F is the futures price, P is the cash price of the deliverable security, r is the short-term collateralized borrowing rate (or repo rate), and y is any coupon interest paid on the security divided by P . To understand the relationship between spot and futures prices, imagine an investor who borrows at the repo rate, takes a long position in the underlying bond, and sells a bond future. At the maturity of the futures contract, the investor can deliver the bond to satisfy the futures contact and use the cash proceeds from the short futures position to repay the borrowing. In competitive markets, the futures price will be such that the transaction does not produce arbitrage profits.

For foreign-exchange futures, the cost-of-carry can be derived from the differential between the interest rates of the domestic and foreign currencies. When foreign interest rates exceed domestic rates, the cost-of-carry is negative. The spread that could be earned on the difference between a short domestic position and a long foreign position would subsidize the combined positions. For the no-arbitrage condition to hold, therefore, a comparable futures position (domestic per foreign) must cost less than the cash (spot) position.

HEDGING

Hedge Ratio

The hedge ratio is used to calculate the number of contracts required to offset the interest-rate risk of an underlying instrument. The hedge ratio is normally constructed by determining the price sensitivity of the hedged item and the price sensitivity of the futures contract. A ratio of these price sensitivities is then formulated to determine the number of futures contracts needed to match the price sensitivity of the underlying instrument.

Interest-Rate Exposure

Financial institutions use futures to manage the risk of their assets and liabilities, as well as off-balance-sheet exposures. Asset/liability management may involve the use of futures to lock in spreads between borrowing and lending rates. For example, a financial institution may sell Eurodollar futures in advance of an anticipated

funding to lock in the cost of funds. If LIBOR subsequently increases, the short futures position will increase in value, offsetting the higher spot interest cost that the financial institution will have to pay on its funding.

These contracts may be used to hedge investment portfolios against yield-curve shifts. Financial institutions can hedge mortgage portfolios by selling futures contracts (or GNMA forwards), and government bond dealers may sell Treasury futures to hedge their inventory. Pension and other types of benefits managers may hedge a fixed future liability by selling futures, or they may hedge an expected receipt by buying futures.

Interest-rate swap dealers use futures (or forwards) to hedge their exposures because directly offsetting swaps with the necessary terms cannot be found easily. The dealers rely on Eurodollar futures, Treasury futures, and floating-rate agreements (a type of interest-rate forward) to hedge their unmatched commitments. For example, a dealer obligated to pay LIBOR may sell Eurodollar futures to protect itself against an increase in interest rates.

Foreign-Exchange Exposure

Corporations engaged in international trade may use foreign-currency contracts to hedge payments and receipts denominated in foreign currencies. For example, a U.S. corporation that exports to Germany and expects payment in DM could sell DM futures (or forwards) to eliminate the risk of lower DM spot rates at the time that the payment arrives. A corporation may also use foreign-exchange contracts to hedge the translation of its foreign earnings for presentation in its financial statements.

Financial institutions use foreign-exchange futures (or forwards) to hedge positions arising from their businesses dealing in foreign exchange. An institution that incurs foreign-exchange exposure from assisting its customers with currency risk management can use offsetting contracts to reduce its own exposure. A financial institution can also use futures (or forwards) to cover unmatched currency swaps. For example, a dealer obligated to make a series of DM payments could buy a series of DM futures (or forwards) to reduce its exposure to changes in the DM/\$ exchange rate.

RISKS

Users and brokers of futures face various risks, which must be well understood and carefully managed. The risk-management methods applied to futures (or forwards) may be similar to those used for other derivative products.

Credit Risk

Unlike OTC derivative contracts, the credit risk associated with a futures contract is minimal. The credit risk in futures is less because the clearinghouse acts as the counterparty to all transactions on a given exchange. An exchange's clearinghouse may be a division of the exchange, as in the case of the CME, or may be a separately owned and operated entity, such as the Chicago Board of Trade Clearing Corporation (BOTCC) or the London Clearing House (LCH). In addition to the credit protection a futures clearinghouse receives from prospective (initial) margin and the daily contract revaluations and settlement (marking to market), a clearinghouse is usually supported by loss-sharing arrangements with its clearing member firms. These loss-sharing provisions may take the form of limited-liability guarantees ("pass-the-hat rules" (BOTCC, LCH)) or unlimited-liability guarantees ("good-to-the-last-drop rules" (CME, NYMEX, SIMEX)). Because of these safeguards, no customer has lost money due to default on a U.S. futures exchange.

In addition, customer-account segregation significantly reduces the risk a customer faces with regard to excess margin funds on deposit with its FCM. Segregation is required for U.S. futures brokers but is less common overseas. However, even with customer-account segregation, FCM customers are exposed to the performance of the FCM's other customers. Unlike a U.S. broker-dealer securities account, the futures industry does not have a customer insurance scheme such as the Securities Investor Protection Corporation (SIPC). The exchanges and their clearinghouses often maintain small customer-guarantee funds, but disbursement from these funds is discretionary.

Finally, clearinghouses maintain their margin funds in their accounts at their respective settlement banks. These accounts are not unique and carry the same credit risks as other demand deposit accounts at the bank. For this reason, the

European Capital Adequacy Directive assigns futures and options margins a 20 percent risk-based capital treatment.

Market Risk

Because futures are often used to offset the market risk of other positions, the risk of these contracts should be evaluated by their effect on the market risk of the overall portfolio. Institutions that leave positions in the portfolio unhedged may be more exposed to market risk than institutions that “run a matched book.” A financial institution may choose to leave a portion of its exposure uncovered to benefit from expected price changes in the market. If the market moves against the institution’s prediction, the institution would incur losses.

Basis Risk

Basis risk is the potential for loss from changes in the price or yield differential between instruments in two markets. Although risk from changes in the basis tends to be less than that arising from absolute price movements, it can sometimes represent a substantial source of risk.

With futures, basis may be defined as the price difference between the cash market and a futures contract. As a contract matures, the basis fluctuates and gradually decreases until the delivery date, when it equals zero as the futures price and the cash price converge. Basis on interest-rate futures can vary due to changes in the shape of the yield curve, which affects the financing rate for holding the deliverable security before delivery. In foreign currency, basis risk arises from changes in the differential between interest rates of two currencies.

Investors may set up hedges with futures, which leave them vulnerable to changes in basis between the hedge and the hedged instrument. For example, Treasury note futures could be sold short to hedge the value of a medium-term fixed-rate corporate loan. If market forces cause credit spreads to increase, the change in value of the hedge may not fully offset the change in value of the corporate bond.

Yield-curve risk may also arise from holding long and short positions with equal durations but different maturities. Although such arrangements may protect against a parallel yield-curve shift, they may leave investors exposed to the

risk of a nonparallel shift causing uneven price changes.

Liquidity Risk

Because of the multilateral netting ability of a futures clearinghouse, futures markets are generally more liquid than their equivalent OTC derivative contracts. However, experience varies with each product and market. In the futures markets, most liquidity is found in near-term contracts and can be rather thin in the more distant contracts.

Clearing and Settlement Risk

In OTC markets, clearing and settlement occurs on a bilateral basis, exposing counterparties to intraday and overnight credit risks. To reduce these risks as well as transactions costs, many financial institutions have bilateral netting arrangements with their major counterparties. Position netting allows counterparties to net their payments on a given day, but does not discharge their original legal obligations for the gross amounts. Netting by novation replaces obligations under individual contracts with a single new obligation.

ACCOUNTING TREATMENT

The accounting treatment for foreign-currency futures contracts is determined by the Financial Accounting Standards Board’s Statement of Financial Accounting Standards No. 133 (FAS 133), “Accounting for Derivatives and Hedging Activities,” as amended by Statement of Financial Accounting Standards Nos. 137 and 138 (FAS 137 and FAS 138). (See section 2120.1, “Accounting,” for further discussion.)

RISK-BASED CAPITAL WEIGHTING

The credit-equivalent amount of a financial futures contract is calculated by summing—

1. the mark-to-market value (positive values only) of the contract and
2. an estimate of the potential future credit exposure over the remaining life of each contract.

The conversion factors are below.

<i>Remaining maturity</i>	<i>Credit-conversion factor</i>
One year or less	0.00%
Five years or less	0.50%
Greater than five years	1.50%

If a bank has multiple contracts with a counterparty and a qualifying bilateral contract with the counterparty, the bank may establish its current and potential credit exposures as net credit exposures. (See section 2110.1, "Capital Adequacy.")

LEGAL LIMITATIONS FOR BANK INVESTMENT

Banks may invest in any futures contract. How-

ever, in taking delivery of nonfinancial products, the bank may need to place the physical commodity in other real estate owned (OREO). In addition, the bank may not engage in the buying and selling of physical commodities or hold itself out as a dealer or merchant in physical commodities.

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GENERAL DESCRIPTION

Interest-rate swaps are over-the-counter (OTC) derivative contracts in which two parties agree to exchange interest cash flows or one or more notional principal amounts at certain times in the future according to an agreed-on formula. The cash flows may be in the same currency or a different currency. The formula defines the cash flows using one or more interest rates and one or more hypothetical principal amounts called *notional principal amounts*.

As an example, suppose that Company A and Bank B enter into a three-year interest-rate swap, in which Bank B agrees to pay a 6 percent fixed rate (quoted on a 30/360-day count basis) on a notional principal of \$100 million, every six months, on January 1 and July 1. In return, Company A agrees to pay U.S. dollar six-month LIBOR on the same dates, on the same notional principal. Thus, the cash flows on the swap will have semiannual fixed-rate payments of \$300,000 going to Company A on each January 1 and July 1, and floating payments based on the prevailing level of U.S. dollar six-month LIBOR on each January 1 and July 1 going to Bank B. These semiannual cash flows will be exchanged for the three-year life of the swap.

Banks, corporations, sovereigns, and other institutions use swaps to manage their interest-rate risks, reduce funding costs (fixed or floating), or speculate on interest-rate movements. Banks (commercial, investment, and merchant) also act as *swaps dealers* or *brokers* in their role as financial intermediaries. As a dealer, a bank offers itself as a counterparty to its customers. As a broker, a bank finds counterparties for its customers, in return for a fee.

The interest-rate swaps market has grown rapidly since its inception in the early 1980s. As of March 1995, interest-rate swaps accounted for 69 percent of the market in interest-rate derivatives, in terms of notional principal outstanding. The notional principal outstanding in swaps at this date was \$18.3 trillion. The gross market value of these swaps was \$562 billion, or 87 percent of all interest-rate derivative contracts.

CHARACTERISTICS AND FEATURES

Swap Terminology and Conventions

An interest-rate swap is an off-balance-sheet, OTC contractual agreement in which two counterparties agree to make interest payments to each other, based on an amount called the notional principal. In an interest-rate swap, only the interest payments are exchanged; the notional principal is not exchanged, it is used only to calculate the interest payments. Each counterparty's set of payments is called a *leg* or *side* of the swap. The fixed-rate payer has *bought the swap*, or is *long the swap*. Conversely, the floating-rate payer has *sold the swap*, or is *short the swap*. The counterparties make *service payments* at agreed-on periods during the swap's tenor. The payer of a fixed leg makes service payments at a fixed price (or rate). The payer of a floating leg makes payments at a floating price that is periodically *reset* using a *reference rate*, which is noted on specific reset dates. The actual dates on which payments are made are payment dates.

The reference floating rate in many interest-rate swap agreements is the *London Interbank Offered Rate (LIBOR)*. LIBOR is the rate of interest offered on short-term interbank deposits in Eurocurrency markets. These rates are determined by trading between banks, and they change continuously as economic conditions change. One-month, three-month, six-month, and one-year maturities are the most common for LIBOR quoted in the swaps market. Other floating-rate indexes common to the swaps market include prime, commercial paper, T-bills, and the 11th District Cost of Funds Index (COFI).

A day count convention for the fixed-rate and floating-rate payments is specified at the beginning of the contract. The standard convention is to quote the fixed leg on a semiannual 30/360-day basis, and to quote LIBOR on an actual/360-day basis. The fixed and floating legs, however, can be quoted on any basis agreed to by the counterparties.

The date that the swap is entered into is called the *trade date*. The calculation for the swap starts on its *settlement date* (effective or value date). Unless otherwise specified in the agree-

ment, the settlement date on U.S. dollar interest-rate swaps is two days after the trade date. The swap ends on its *termination* or *maturity* date. The period of time between the effective and termination dates is the swap's *tenor* or *maturity*.

Swap Agreement

Swaps are typically initiated through telephone conversations and confirmed by fax, telex, or letter (a *confirmation*). Both parties are legally bound by the initial agreement and complete documentation is not exchanged until later. Swap contracts are usually executed according to the standards of the International Swaps and Derivatives Association (ISDA) or the British Bankers Association's Interest-Rate Swaps (BBAIRS). The complete documentation of a particular swap consists of the confirmation; a payment schedule (in a format standardized by ISDA or BBAIRS); and a *master swap agreement* that uses standard language, assumptions, and provisions. As a rule, counterparties execute one master agreement to cover all their swaps. Thus, two different swaps may have different confirmations and payment schedules but may use the same master agreement. The master agreements cover many issues, such as (1) termination events; (2) methods of determining and assessing damages in case of default or early termination; (3) netting of payments; (4) payment locations; (5) collateral requirements; (6) tax and legal issues; and (7) timely notification of changes in address, telex numbers, or other information.

Types of Swaps

This general swap structure permits a wide variety of generic swaps. Common types of interest-rate swaps are outlined below.

- The *generic* (or *plain vanilla*) swap has a fixed and a floating leg; the notional amount and payments are all in the same currency.
- The *basis* (or *floating-for-floating*) swap has two floating legs, each tied to a different reference rate. These instruments are often used to reduce basis risk for a balance sheet that has assets and liabilities based on different indexes.
- The *forward swap* has a settlement at some agreed-on future date. A forward swap allows

counterparties to lock in a fixed rate (as a payer or receiver) at the time of contract origination, but to postpone the setting of the floating rate and the calculation of cash flows until some time in the future. These swaps are often used to hedge future debt refinancings or anticipated issuances of debt.

- The *amortizing swap* has a notional principal which is reduced at one or more points in time before the termination date. These swaps are often used to hedge the interest-rate exposure on amortized loans, such as project-finance loans.
- The *accreting swap* has a notional principal which is increased at one or more points in time before the termination date. These swaps are often used to hedge the interest-rate exposure on accreting loans, such as the draw-down period on project-finance loans.
- The *zero-coupon swap* is a fixed-for-floating swap in which no payments are made on the fixed leg until maturity. These swaps are often used to hedge the exposure on a zero-coupon instrument.
- *Callable, puttable, and extendible swaps* are swaps with embedded options in which one party has the right, but not the obligation, to extend or shorten the tenor of the swap. As the counterparty has sold an option to the swap dealer in these transactions, the swaps will have a lower fixed rate in the case of a fixed-rate payer and a higher fixed rate in the case of a fixed-rate receiver. The counterparty is, however, subject to call or extension risk.
- The *seasonal swap* has different payment dates for the two legs (which may both be fixed), usually tied to the counterparties' cash-flow needs. These swaps are often used to create synthetic cash flows when actual cash flows change over time. This technique is called *deseasoning*. For example, suppose Firm A expects to make \$120 million a year, or on average \$10 million a month, but also expects to earn on average \$15 million a month in June, July, and August; \$5 million a month in May, September, and October; and \$10 million a month in the remaining months. It can enter into a seasonal swap in which it pays \$5 million a month in June, July, and August, when its revenues are high, and receives \$5 million a month in May, September, and October, when its revenues are low.

USES

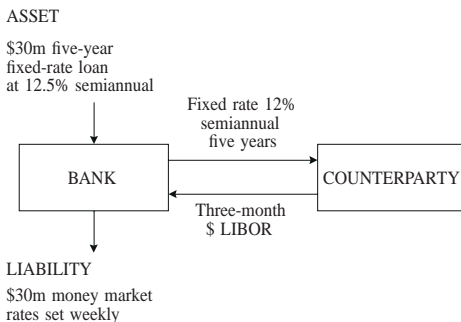
Interest-rate swaps are used for hedging, investment, and speculative purposes. Interest-rate swaps are also used to reduce funding costs and arbitrage purposes. Examples of how banks use interest-rate swaps for asset/liability management, investment purposes, and speculation are shown below.

Asset/Liability Management: Closing the Balance-Sheet Gap

Suppose a bank has a \$30 million, five-year, fixed-rate loan asset with a semiannual coupon of 12.5 percent which it has funded with \$30 million of money market deposits. The bank is faced with a balance-sheet gap—the asset has a fixed rate of interest, but the cost of the underlying liability resets every week. The risk faced by the bank is that a rise in short-term interest rates will cause the cost of its liabilities to rise above the yield on the loan, causing a negative spread. The bank can use a fixed-for-floating interest-rate swap to achieve a closer match between its interest income and interest expense, thereby reducing its interest-rate risk (see figure 1).

As shown in figure 1, the bank has entered into a five-year interest-rate swap in which it pays a dealer 12 percent and receives three-month U.S. dollar LIBOR. In effect, the bank has locked in a positive spread of 50 basis points.

Figure 1



Cash Flows on Transaction

Assumed cost of money market deposits (pays)	-3-month LIBOR
Swap inflow (receives)	+3-month LIBOR
Swap outflow (pays)	-12.00%
Loan interest inflow (receives)	+12.50%
<hr/>	
Net position with hedge	+50 basis points

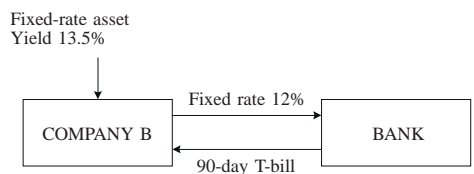
While the bank has effectively locked in a positive 50 basis point spread, it remains subject to basis risk between the three-month U.S. dollar LIBOR rate which it is receiving in the swap and the weekly money market rates which it pays to its depositors.

Investment Uses: Transforming a Fixed-Rate Asset into a Floating-Rate Basis

Interest-rate swaps are often used by investment managers to create synthetic assets, often in response to temporary arbitrage opportunities between the cash and derivative markets. A plain vanilla interest-rate swap can be used to transform the yield on a fixed- (floating-) rate asset such as a corporate bond into a floating- (fixed-) rate asset.

As an example, suppose that the investment manager of Company B has a five-year fixed-rate bond which yields 13.5 percent. Also, suppose that the investment manager has a strong view that interest rates will rise, but does not want to sell the bond because its credit quality could improve substantially in the future. To position the portfolio for a rise in rates without selling the bond, the investment manager can enter into an interest-rate swap in which Company B pays a fixed rate of 12 per-

Figure 2



cent and receives a floating rate based on the 90-day T-bill rate, effectively creating a synthetic floating-rate security yielding the 90-day T-bill rate plus 150 basis points (see figure 2).

Cash Flows on Transaction

Fixed rate on bond (receives)	+13.50%
Fixed rate on swap (pays)	-12.00%
Floating-rate 90-day T-bill (receives)	+90-day T-bill

Net Rate Received by Company B 90-day T-bill + 1.50%

Speculation: Positioning for the Expectation of Rate Movements

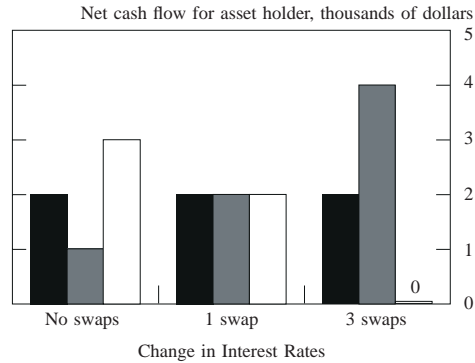
Interest-rate swaps can be used to take a position on interest-rate movements. In this example, an end-user establishes positions with swaps, believing that interest rates will fall in a six-month period. The end-user believes that short-term interest rates will decrease, but does not want to sell its floating-rate asset. The end-user can therefore enter into an interest-rate swap to receive a fixed rate of interest and pay a floating rate of interest, thereby converting the floating-rate asset to a fixed-rate basis.

Figure 3 shows the cash flow to an end-user who has a \$100,000 asset indexed to LIBOR, under various interest-rate scenarios for a period of six months. The vertical axis shows the end-user's net cash flow after six months, and the horizontal axis shows different interest-rate exposure strategies, ranging from holding the asset without entering into interest-rate swaps to entering into swaps to pay LIBOR and receive a fixed rate.

In each of the three clusters of bars on the horizontal axis, the return to the end-user under different interest-rate scenarios is displayed (from left to right) for no change in interest rates, a 2.00 percent decrease in interest rates, and a 2.00 percent increase in interest rates. As can be seen from the middle bar in the first cluster (the "no swaps" scenario), if the investor is correct and short-term interest rates decrease, the return on the asset will fall dramatically.

The second cluster of bars on the horizontal axis (the "1 swap" scenario) shows the asset return after the investor has entered into one

Figure 3—Using Plain Vanilla Swaps to Leverage Interest-Rate Exposure



- Interest rates unchanged
- Interest rates decrease
- Interest rates increase 2%

End-user has \$100,000 asset indexed to LIBOR. In the swaps, the end-user pays LIBOR and receives fixed → converts asset to fixed-rate basis.

swap based on a notional principal amount of \$100,000 (equal to the amount invested in the asset), in which the investor pays a floating rate and receives a fixed rate. This swap is effectively a hedge which transforms the floating-rate asset return to a fixed-rate basis so that the asset return remains constant under all interest-rate scenarios.

The third cluster of bars on the horizontal axis (the "3 swaps" scenario) demonstrates the return from the investor's "leveraged" speculation that short-term interest rates will decrease. Here, the investor enters into three interest-rate swaps based on a notional principal of \$100,000 (which is equivalent to one swap based on a notional principal of \$300,000), in which the investor pays a floating rate and receives a fixed rate. Again, the first swap effectively transforms the floating-rate asset to a fixed-rate basis; in the second and third swaps, the investor receives (pays) the differential between the fixed and floating rates in the swap. Hence, if interest rates decrease 2.00 percent and the investor has entered into three interest-rate swaps (the middle bar in the third cluster), the asset return is increased substantially compared to just holding onto the asset (the middle bar in the first cluster). However, if the investor is wrong, and interest rates increase 2.00 percent after three interest rates have been entered into, the return on the asset will be zero.

DESCRIPTION OF MARKETPLACE

Primary Market

The primary market for interest-rate swaps consists of swap dealers, swap brokers, and end-users.

Brokers and Dealers

Financial institutions, such as commercial banks, investment banks, and insurance companies, act as *dealers* in interest-rate swaps. Banks are a natural intermediary in the swaps market because of their exposure to interest-rate movements and their expertise in analyzing customer credit risk.

Swap brokers are paid a fee for arranging a swap transaction between two counterparties. Swap brokers do not take positions and do not act as a counterparty to a swap transaction.

End-Users

End-users of interest-rate swaps include financial institutions, corporations, sovereigns, government-sponsored enterprises (GSEs), and money managers. Banks who are dealers often also use swaps in an end-user capacity for asset/liability management, funding, and investment purposes. End-users use interest-rate swaps for hedging, investment, and speculative purposes. They also often use interest-rate swaps to reduce funding costs.

The nature of an end-user's business often determines whether he or she will wish to be a fixed-rate receiver or a fixed-rate payer. Fixed-rate payers are often firms whose minimum cash flows are reasonably predictable regardless of the level of interest rates. This class includes manufacturing and distribution firms in the developed countries, financial institutions with large portfolios of fixed-rate assets, and national agencies of certain developed countries that have difficulty accessing fixed-rate funds.

Fixed-rate receivers are often highly sensitive to changes in short-term market rates of interest. This class includes large money-center or regional banks that have large portfolios of floating-rate assets. The interest rates on the assets held in their loan portfolios may be indexed to U.S. prime rates, LIBOR, or other

short-term market rates. The class also includes borrowers who have fixed-rate debt outstanding and prefer to convert it to floating-rate debt. Institutions such as life insurance companies, pension funds, wealthy investors, and managed trust accounts are notable examples of natural fixed-rate receivers.

Secondary Market

If a counterparty wishes to terminate, or *unwind*, an existing swap position in the secondary market, it must do so by one of three methods: *swap reversal*, *swap assignment*, or *swap buy-back* (also called *close-out* or *cancellation*).

In a swap reversal, a counterparty of a swap enters into an offsetting swap with the same terms as the original swap. For example, if Firm A is in a fixed-for-floating swap, paying 10 percent on \$10 million notional for U.S. dollar three-month LIBOR, with one year to maturity, the offsetting swap would be a one-year floating-for-fixed swap, paying U.S. dollar three-month LIBOR for 10 percent on \$10 million notional. If market rates have changed since the position was initiated, which is likely, a *mirror offsetting position* cannot be established unless a fee is paid to establish the off-market mirror transaction. For instance, in the example above, if one-year rates at the time that the mirror swap is traded are 8 percent, the counterparty will have to pay a fee of approximately \$185,000 to enter into the mirror trade ($(10\text{ percent} - 8\text{ percent}) \times \$10\text{ million discounted at } 8\text{ percent}$). The counterparty does not cancel the first swap; it adds a second swap to its books at the cost of increasing default risk.

In a swap assignment, a counterparty finds a new counterparty who is willing to assume its position in the swap. Swap assignments require the acquiescence of the other counterparty to the swap. At the time of the assignment, a payment representing the net present value of the swap is made either to or from the new assigned counterparty. For example, using the example above in which Firm A is in a 10 percent one-year fixed-for-floating swap, Firm A can assign its position in the swap to a new counterparty—Counterparty B (usually a dealer). In this case, as the swap has a negative mark-to-market value for Firm A, Firm A will be required to make a payment of \$185,000 to Counterparty B. Counterparty B then assumes Firm A's position in the

swap with the original counterparty. A key issue in swap sales is the creditworthiness of the firm or dealer who will assume the swap. If the creditworthiness is poor, the other counterparty may not agree to the sale.

In a buy-back, one of the counterparties to a swap sells the swap to the other counterparty. Unlike the swap assignment example above, buy-backs are between the original counterparties and do not involve a third party. Buy-backs usually involve a payment which is based on the mark-to-market value of the swap at the time of the buy-back. In the example above, Firm A would be required to make a payment of \$185,000 to the other original counterparty to terminate the swap.

Market Transparency

Market transparency in the swaps market is generally high. Market quotes are readily available on sources such as Telerate and Bloomberg. Increased competition has, in part, led to the narrowing of bid/offer spreads on plain vanilla deals. For instance, in the early 1980s, bid/offer spreads were in the 40 to 50 basis point range for deals under five years, and liquidity was almost nonexistent for deals beyond 10 years. Today, spreads have narrowed to 1 to 3 basis points for swaps under 10 years, and liquidity has increased significantly on swaps beyond 10 years.

Liquidity in the secondary market is high but is somewhat less than in the primary market because it is cumbersome to unwind existing positions. To make the secondary market more liquid, several people have proposed the creation of a clearing corporation similar to the clearing corporations for futures and options. If this happens, the disadvantages for end-users would be less customization and more regulation. The advantages would be reduction in default (credit) risk and increased transparency.

PRICING

Market Conventions and Terminology

The market convention for pricing swaps is to quote the fixed rate in terms of a basis point spread over the Treasury rate (usually quoted

on a semiannual bond-equivalent yield basis) as the price for receiving the floating-interest-rate index flat (no basis points are added to or subtracted from the floating rate). For example, if an investor wants to receive a floating rate, such as LIBOR, the fixed rate it will have to pay would be the current *on-the-run* Treasury yield for the appropriate maturity category of the swap, plus a basis point spread over that yield (on-the-runs are the securities of the relevant maturity that were most recently auctioned). This basis point spread over the relevant Treasury is called the swap spread. For example, assuming that the on-the-run two-year Treasury yield is 6.00 percent and a two-year swap is quoted at 18/20 (bid/offer), then a fixed-rate receiver would pay the dealer LIBOR and receive a fixed rate of 6.18 percent, and a fixed-rate payer would pay the dealer 6.20 percent to receive LIBOR flat.

It is important to distinguish between the swap spread and the bid/offer spread (discussed above in the primary market information). The swap spread is the spread over the Treasury yield to pay or receive fixed while the *bid/offer spread* is the difference between the fixed rate which must be paid to the market maker and the fixed rate that the market maker will pay. The swap spread represents the difference between investment-grade spreads (from Euro-dollar futures and corporate bond markets) and the risk-free rate of Treasury securities. This spread adjustment is appropriate because non-U.S.-government swap counterparties typically cannot borrow at risk-free Treasury rates. The supply and demand for fixed-rate funds also influences the swap spread. For instance, if there is a predominance of fixed-rate payers in the market, swap spreads will increase as the demand for paying fixed on swaps will exceed the supply of dealers willing to book these swaps, thus bidding up the spread.

Swaps are priced relative to other funding and investment vehicles with the same type of exposure. For shorter maturities, in which liquid interest-rate futures contracts are available, swaps are priced relative to futures contracts. Swaps of one- to five-year maturities are generally priced relative to Eurodollar futures.

At longer maturities, swaps are priced relative to rates in alternative traditional fixed- and floating-rate instruments. For instance, swap spreads for 5- to 10-year maturities are roughly equivalent to investment-grade (single A or higher) corporate spreads over U.S. Treasuries.

Pricing Using Eurodollar Futures Contracts

An interest-rate swap can be thought of as a series of forward contracts. As such, if forward rates are observable, a swap can be priced as a series of these forward contracts. Eurodollar futures contracts are observable, liquid market forward rates for U.S. dollar LIBOR. As the fixed rate on a swap is simply the blended forward rates for each floating reset date, swaps can be priced by reference to the Eurodollar strip (a series of Eurodollar futures contracts) out to the maturity date of the swaps contract. For example, consider a hypothetical one-year swap starting March 19, 1997, and terminating March 18, 1998 (March to March contract dates).

Step 1: Determine forward rates by reference to the one-year Eurodollar strip.

Month	Futures Price	Rate
March '97		5.75% (spot 3-month LIBOR)
June '97	94.07	5.93% (100 - 94.07)
September '97	93.82	6.18% (100 - 93.82)
December '97	93.60	6.40% (100 - 93.60)

Step 2: Calculate the swap rate based on the following formula:

$$\begin{aligned}
 R = & ([1 + R_0(D_0/360)] \\
 & \times [1 + F_1(D_1/360)] \\
 & \times \dots \\
 & \times [1 + F_n(D_n/360)] - 1) \\
 & \times 360/365
 \end{aligned}$$

where

R = Eurodollar strip rate (swap rate) stated as an annualized money market yield

R_0 = spot LIBOR to first futures expiration
 F_1 = first futures contract (100 - futures price)
 F_n = futures rate for the last relevant contract in the strip
 D_i = actual number of days in each period

$$\begin{aligned}
 R = & ([1 + .0575(91/360)] \\
 & \times [1 + .0593(91/360)] \\
 & \times [1 + .0618(91/360)] \\
 & \times [1 + .064(91/360)] - 1) \\
 & \times 360/364 \\
 R = & 6.21\%
 \end{aligned}$$

The above example is simplified because the swap begins and terminates on contract expiration dates. However, a similar methodology incorporating stub periods can be used to price swaps which do not fall on contract expiration dates by using the following generalized formula:

$$\begin{aligned}
 & [1 + R_0(D_0/360)] \\
 & \times [1 + F_1(D_1/360)] \\
 & \times \dots \\
 & \times [1 + F_n(D_n/360)] \\
 = & [1 + R(365/360)]^N \\
 & \times [1 + R(D_r/360)]
 \end{aligned}$$

where

D_r = total number of days in the partial-year period of the strip

N = number of whole years in the strip

Swaps are often priced using the Eurodollar strip for maturities of five years or less when liquidity in the Eurodollar strip is high.

Pricing Using Zero-Coupon Methodology

A zero-coupon methodology, another method used to value swap contracts, is often used to value swaps with maturities greater than five years. Unlike a yield-to-maturity (*YTM*) method in which each cash flow is valued at a constant discount rate, a zero-coupon methodology discounts each cash flow by a unique zero-coupon (spot) rate. A zero-coupon rate (zero) can be

thought of as the *YTM* of a zero-coupon bond. As such, the return in period n on a zero-coupon bond can be derived by making n period investments at the current forward rates. For instance, the discount factors for a three-period instrument priced on a *YTM* basis would be derived as follows.

YTM discount factors:

$$[1/(1 + YTM)] + [1/(YTM)^2] + [1/(YTM)^3],$$

where *YTM* = constant yield-to-maturity rate.

The discount factors for a three-period instrument priced on a zero-coupon basis would be derived as follows.

Zero-coupon discount factors:

$$\begin{aligned} & [1/(1 + S_0)] + [1/(1 + S_0)(1 + {}_1f_2)] \\ & + [1/(1 + S_0)(1 + {}_1f_2)(1 + {}_2f_3)], \end{aligned}$$

where

S_0 = Spot zero rate at time 0

${}_1f_2$ = forward rate for time period 1 to 2

${}_2f_3$ = forward rate for time period 2 to 3.

Zero-coupon swap rates can be calculated either from the price of an appropriate zero-coupon swap or from a series of forward rates such as the Eurodollar futures strip. The market in zero-coupon swaps, however, is not active and zero-coupon prices are not observable. However, zero-coupon swap rates can be derived from observable coupon-bearing swaps trading in the market using a technique called *bootstrapping*. Once zero-coupon swap rates have been derived, an interest-rate swap can be priced similar to a fixed-rate bond by solving for the swap rate which, when discounted by the appropriate zero-coupon rates, will equate the swap to par.

The first step in the bootstrapping method is to construct a swap yield curve based on coupon-paying swaps trading in the market. Once this yield curve has been constructed, the coupon rates on the swaps can be used to calculate zero swap rates. Based on the observable first-period swap rate, a zero rate can be derived for the first period. Often, this rate may already be stated on a zero-coupon basis, such as six-month LIBOR (coupons are not paid on the instrument). The first period zero rate (z_1) is derived by discount-

ing the coupon rate on the first-period instrument by the zero-coupon rate which gives a price equal to par.

$$100 = (100 + c_1)/(1 + z_1),$$

where

c_1 = coupon rate on first-period instrument

z_1 = zero coupon rate for first period.

The first-period zero rate and the second-period coupon swap rate are then used to calculate the second-period zero rate (z_2) using the following relationship:

$$100 = [c_2/(1 + z_1)] + [(100 + c_2)/(1 + z_2)^2],$$

where

c_2 = coupon rate on second-period instrument

z_1 = zero-coupon rate for period 1

z_2 = zero-coupon rate for period 2.

This process is then continued to calculate an entire zero-rate curve. Zero rates for all other dates can then be calculated by interpolation.

As an example of the zero-coupon pricing methodology, consider the following simplified example for a \$100 million two-year amortizing fixed-for-floating interest-rate swap, quoted on an annual basis. The swap amortized by \$50 million at the end of year one, and amortizes to zero at the end of year two.

Step 1: Construct the cash-swap yield curve for two years.

Maturity	On-the-Run		
	Treasury Yield	Swap Spread	Swap Rate (Offer)
1 year	4.80%	.18%-.20%	5.00%
2 year	5.70%	.28%-.30%	6.00%

Step 2: Derive the zero-coupon rates by the bootstrap method.

Using the coupon swap rates from the swap yield curve above, the first-period zero-coupon rate can be solved using the bootstrap method:

$$100 = 105/(1 + z_1)$$

$$z_1 = 5.00\%$$

Likewise, using the above cash-market swap rates to solve for the zero rate in year 2 by the bootstrap method:

$$100 = [6.00/(1.05)] + [106/(1 + z_2)^2]$$

$$z_2 = 6.02\%$$

Step 3: Using iteration, solve for the swap-coupon rate which equates the cash flows on the swap to par using the zero rates obtained in step 2 as the discount factors.

$$\begin{aligned} \$100\text{mm} &= [\$50\text{mm} \\ &+ (100\text{mm} * \text{Swap Coupon}) \\ &\div (1.05)] \\ &+ [\$50\text{mm} \\ &+ (50\text{mm} * \text{Swap Coupon}) \\ &\div (1.0602)^2] \end{aligned}$$

Swap-Coupon Rate = 5.65%

Pricing Unwinds

After a swap has been entered into, the mark-to-market (MTM) value can be calculated by discounting the remaining cash flows on the swap by the appropriate zero-coupon rates prevailing at the time of the termination of the swap. The resulting value, above or below par, would then represent the amount which would be either received or paid to terminate the swap.

For example, using the amortizing swap example above, suppose that after one year, the counterparty who is a fixed-rate payer in the swap wishes to terminate the swap. At the time, one-year swap rates are 7.00 percent. The mark-to-market value of the swap would be calculated as follows:

Step 1: Determine the one-year (time remaining to maturity) zero-coupon rate.

$$100 = 107/(1.07)$$

$$z_1 = 7.00\%$$

Step 2: Discount remaining cash flows on the swap by the zero rate obtained in step 1.

$$\begin{aligned} \text{Price of Swap} &= [\$50\text{mm} + (\$50\text{mm} \times .0565)] \\ &\div (1.07) \end{aligned}$$

$$\text{Price of Swap} = \$49.37 \text{ mm}$$

$$\text{MTM Value} = \$50 \text{ mm} - \$49.37 \text{ mm} = \$630,000$$

In this example, as rates have risen since the inception of the swap, the fixed-rate payer would receive a fee of \$630,000 for terminating the swap.

HEDGING

Any firm that has a position in swaps is exposed to interest-rate, basis, and credit risks (discussed below). From a dealer standpoint, these risks are ideally hedged by entering immediately into mirror (offsetting) swaps, which eliminate exposure to these risks. However, in practice, dealers warehouse swap positions and hedge residual exposure with Eurodollar futures, forward rate agreements, or Treasuries until offsetting swaps can be established. End-users who have a swaps book face the same risks, and apply the same techniques, as dealers.

Hedging Interest-Rate and Basis Risk

Interest-rate risk in a swap portfolio is the risk that an adverse change in interest rates will cause the value of the portfolio to decline. Basis risk arises from an imperfect correlation between the hedge instrument and the instrument being hedged. Interest-rate and basis risk can be hedged one swap at a time (“microhedging”), or a portfolio (set) of swaps can be hedged (“macrohedging”). Microhedging is rare today. In macrohedging, the overall risks of the portfolio (or subsets of it) are evaluated and hedged using offsetting interest-rate swaps and other interest-rate derivatives. Residual exposures are hedged in the Eurodollar futures or Treasury markets. Most dealers dynamically hedge the residual exposure of their swap portfolio by adjusting the hedge position as interest rates change.

Risk managers usually take into account the effect of various interest-rate changes on the profitability of a swap book—for example, when interest rates change by 5, 10, 50, or 100 basis points. Dealers usually hedge for an arbitrary movement in rates, such as 50 basis points, which generally depends on senior management’s risk appetite.

Hedging Credit Risk

The main techniques by which credit risk is hedged are (1) to require collateral if a counter-

party is out of money; (2) to establish termination clauses in the master agreement for assessment of damages in the event of default; (3) to net payments (when several swaps are outstanding with the same counterparty), according to terms established in a master netting agreement (or master agreement); and (4) to sell the swap to another party.

Hedging the credit risk of a swap book is difficult for a number of reasons. First, since there is no formal secondary market in swaps, it may not be immediately possible to trade out of a position. Second, assumptions about the certainty of cash flows and the level and term structure of interest rates are implicit in swap valuation. If these assumptions do not hold, the value of a swap book may not behave as expected, depending on how it is hedged. Third, to the extent to which some contracts are customized, they may be difficult to value accurately and to hedge.

If risk models are used to estimate a market maker's potential future credit exposure, the assumptions between the risk-management model and the credit-risk model should be consistent. As is the case for risk management, it is important to understand the assumptions in the model in order to estimate potential credit risk.

RISKS

The principal risks in swap contracts are interest-rate, basis, credit, and legal and operating risk. For participants entering into highly customized transactions, liquidity risk may be important because hedging or an assignment of the contract may be difficult.

Interest-Rate Risk

Interest-rate risk for swaps is the risk that an adverse change in interest rates causes the swap's market value to decline. The price risk of interest-rate swaps is analogous to that of bonds. In fact, a swap can be described as an exchange of two securities: a hypothetical fixed-rate bond and a floating-rate note. The swap involves the simultaneous exchange of these two securities of equal amount and maturity, in which netting of principal payments at origination and maturity results in no principal cash flow. Along these lines, a swap dealer who makes fixed-rate payments is considered to be short the bond

market. This dealer has established the price sensitivities of a longer-term liability and a floating-rate asset. The price risk here is that if short-term interest rates decrease, the dealer would be receiving less on the asset but still paying out the same amount on the liability. This interest-rate exposure could be hedged by buying Eurodollar futures (or by being long Treasuries of the same maturity as the swap). Then, if short-term interest rates decrease, the gain on the hedge should offset the loss on the swap.

Basis Risk

A major form of market risk that dealers are exposed to is basis risk. Dealers have to hedge the price exposure of swaps they write until offsetting swaps are entered into, and the hedges may not be perfect.

Basis risk affects profitability. The bid/offer spread is the profit a dealer can make on a hedged swap book, but the dealer can earn less than this due to basis risk.

Sources of Basis Risk

When a dealer hedges swaps that have some credit risk with instruments of little or no credit risk (Treasuries), it creates basis risk. For instance, dealers often hedge swaps with maturities of five or more years with Treasuries. The risks in the swaps usually include credit risks, which are reflected in the floating rate(s). Since Treasuries are credit-risk-free securities, they do not provide a perfect hedge; this is a source of basis risk for the dealer, since there can be divergence between the two rates. Dealers are exposed to TED (Treasury-Eurodollar) spread risk when they hedge swaps of shorter maturities with Treasuries. In essence, the price of Eurodollar futures can change, which will cause swap spreads to change even if Treasury prices remain the same, since the swap spread is linked to the difference between the Eurodollar and Treasury markets.

Credit Risk

After the swap is executed, changes in interest rates cause the swap to move in the money for one counterparty and out of the money for the

other. For example, an increase in market interest rates would increase the floating-rate payments from a swap, causing the value of the swap to the fixed-rate payer to rise and the value of the swap to the floating-rate payer to fall.

As no principal amount is exchanged in an interest-rate swap contract, credit risk is significantly less than it is on instruments in which principal is at risk. Credit-related loss can occur when the counterparty of an in-the-money swap defaults. The credit loss would be limited to the present value of the difference between the original and current market rates over the remaining maturity of the contract, which is called the replacement cost of the swap. For example, if a dealer had originally swapped fixed payments at 8.5 percent for six-month LIBOR for seven years, and the current market rate for the same transaction is 10 percent, the actual loss when a counterparty defaulted at the end of the first year would be the present value of 1.5 percent over six years on the notional principal amount of the swap.

Credit risk is a function of both current credit exposure and potential future credit exposure. The example above only illustrates current credit exposure. Potential future exposure depends primarily on the volatility of interest rates. One approach to estimating peak potential credit exposure (PkCE) is to perform a full-blown Monte Carlo simulation on a counterparty's portfolio. This strategy has many appealing features and is the most statistically rigorous. In essence, the model is calculating "maximum" potential market value of the transaction, given a set of market conditions and a set confidence interval. However, problems arise from having to assume desired correlations among variables when making multiple simulations of market conditions. These correlations need to hold true over the life of the contract and be adjusted for the introduction of new instruments. Aside from these methodology problems, it is almost impossible to run the necessary number of simulated portfolio market values within response times acceptable to the trading floor. Also, Monte Carlo simulations do not readily highlight the specific sources of potential exposure or suggest ways to neutralize this exposure.

An alternative to the full-blown Monte Carlo strategy can be characterized as the "primary-risk-source approach." This approach attempts to identify the market variable that is the primary source of changes in the contract's value and then simulate values based on changes in

this variable. In practice, a single market variable is not usually the only factor that causes a contract's value to change. However, other factors that might affect the value are generally of secondary importance. In addition, if the secondary-market variables are not highly correlated with the primary risk source, their impact on market value is further reduced.

Estimating PkCE for a single contract can be complex. Accurately estimating PkCE for a portfolio of contracts executed with one counterparty can be so analytically difficult or computationally intensive that it is not always feasible. A tradeoff has to be made between the ideal methodology and the computational demands.

Other factors that affect potential credit exposure include the shape and level of the yield curve, the frequency of payments, the maturity of the transaction, and whether collateral has been posted. In addition, the changing credit quality of counterparties can affect potential credit risk.

Legal Risk

Legal risk arises from the possibility that a swap contract will not be enforceable or legally binding on the counterparty. For instance, the enforcement of netting agreements with foreign counterparties varies by country and may expose a counterparty to risk in case of nonenforceability. As such, the adequacy of legal documentation, including master swap agreements and netting agreements, should be reviewed.

ACCOUNTING TREATMENT

The accounting treatment for swap instruments is determined by the Financial Accounting Standards Board's Statement of Financial Accounting Standards No. 133 (FAS 133), "Accounting for Derivatives and Hedging Activities," as amended by Statement of Financial Accounting Standards Nos. 137 and 138 (FAS 137 and FAS 138). (See section 2120.1, "Accounting," for further discussion.)

RISK-BASED CAPITAL WEIGHTING

The credit-equivalent amount of an interest-rate swap contract is calculated by summing—

1. the mark-to-market value (positive values only) of the contract and
2. an estimate of the potential future credit exposure over the remaining life of each contract.

The conversion factors are as follows.

<i>Remaining maturity</i>	<i>Credit-conversion factor</i>
One year or less	0.00%
Five years or less	0.50%
Greater than five years	1.50%

If a bank has multiple contracts with a counterparty and a qualifying bilateral contract with the counterparty, the bank may establish its current and potential credit exposures as net credit exposures. (See section 2110.1, "Capital Adequacy.")

LEGAL LIMITATIONS FOR BANK INVESTMENT

Swaps are not considered investments under 12 USC 24 (seventh). The use of these instruments is considered to be an activity incidental to banking within safe and sound banking practices.

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GENERAL DESCRIPTION

Options transfer the right but not the obligation to buy or sell an underlying asset, instrument, or index on or before the option's exercise date at a specified price (the *strike price*). A *call option* gives the option purchaser the right but not the obligation to purchase a specific quantity of the underlying asset (from the call option seller) on or before the option's exercise date at the strike price. Conversely, a *put option* gives the option purchaser the right but not the obligation to sell a specific quantity of the underlying asset (to the put option seller) on or before the option's exercise date at the strike price.

The designation "option" is only applicable to the buyer's status in the transaction. An option *seller* has an obligation to perform, while a *purchaser* has an option to require performance of the seller and will only do so if it proves financially beneficial.

Options can be written on numerous instruments. Commercial banks are typically involved most with interest-rate, foreign-exchange, and some commodity options. Options can be used in bank dealer activities, in a trading account, or to hedge various risks associated with the underlying instruments or portfolio.

CHARACTERISTICS AND FEATURES

A basic option has six essential characteristics, as described below.

1. *Underlying security.* An option is directly linked to and its value is derived from a specific security, asset, or reference rate. Thus, options fit into the classification of "derivative instruments." The security, asset, index, or rate against which the option is written is referred to as the option's *underlying instrument*.
2. *Strike price.* The strike price is the price at which an option contract permits its owner to buy or sell the underlying instrument. The strike price is also referred to as the exercise price. A call option is said to be in the money when the price of the underlying asset exceeds the strike price. A put option is in the money

when the price of the asset is less than the exercise price.

3. *Expiration date.* Options are "wasting assets"; they are only good for a prespecified amount of time. The date after which they can no longer be exercised is known as the *expiration date*.
4. *Long or short position.* Every option contract has a buyer and a seller. The buyer is said to have a long option position, while the seller has a short option position. This is not the same as having a long or short position in the *underlying instrument, index, or rate*. A bank which is *long puts* on government bonds has bought the right to *sell* government bonds at a given strike price. This gives the bank protection from falling bond prices. Conversely, if the bank were *short puts*, it would be obligating itself to *purchase* government bonds at a specific price.
5. *American or European.* The two major classifications of options are American and European. American options can be exercised on any date after purchase, up to and including the final expiration date. European options can be exercised only on the expiration date of the contract. Because American options give the holder an additional privilege of early exercise, they will generally be more valuable than European options. Most exchange options are American, while most over-the-counter (OTC) options are European.
6. *Premium.* The price paid for an option is referred to as the option's *premium*. This premium amount is a dynamic measure of the factors which affect the option's value. Therefore, options with identical contract terms can trade at a multitude of different premium levels over time. Premium has two components: *time value* and *intrinsic value*. Intrinsic value refers to the amount of value in the option if it were exercised today. Time value is the difference between the total premium and the intrinsic value; it encompasses the uncertainty of future price moves. The time value of an option is a function of the security's volatility (or risk); the current level of interest rates; and the option's maturity (or time to expiration). The option's positive time value gradually approaches zero at expiration, with the option price at expiration equal to its intrinsic value.

For example, a long call option with a strike price of \$50 on an underlying security which is trading at \$52 has an intrinsic value of \$2. If the option is trading for a *total* price of \$3.50, \$1.50 of the price ($\$3.50 - \2.00) would be time value, reflecting the fact that the underlying security may further increase in value before the option's expiration. Not all options will have an intrinsic value component; often the entire premium amount is time value.

Exotic Options

In the past few years, the growth of so-called "exotic" derivative products has been significant. Options have been no exception, and many varied types of exotic options exist today which are traded in the OTC markets. Some of the more common exotic options are discussed below.

In general, markets for many of the exotic options are not as liquid as their more generic counterparts. Thus, a quoted price may not be a good indication of where actual liquidation of the trade could take place.

Asian options, also called average-price options, depend on the *average price* of the underlying security during the life of the option. For example, a \$60 call on a security which settled at \$65 but traded at an average price of \$63.5 during the option's life would be worth only \$3.50 at expiration, not \$5. Because of this feature, which essentially translates into lower volatility, Asian options tend to trade for a lower premium than conventional options. These options are generally cash settled, meaning that the actual underlying does not change hands. They belong in the category known as *path-dependent options*, meaning that the option's payoff depends on the path taken by the underlying security before the option's expiration.

Barrier options, are options which either come into existence or cease to exist based on a specified (or barrier) price on the underlying instrument. This also puts them in the category of path-dependent options. The two basic types of barrier options are knock-in and knock-out. A knock-in option, either put or call, comes into existence only when the underlying asset's price reaches a specified level. A knock-out option, either put or call, ceases to exist when the barrier price is reached.

A typical knock-in put option has a barrier price which is higher than the strike price. Thus, the put only comes into existence when and if the barrier price is reached. A knock-out call barrier price is generally below the strike price. A \$60 call with a \$52 barrier would cease to exist if at any time during the option's life the security traded \$52 or lower. Because of this cancelable feature, barrier options trade for lower premiums than conventional options.

An important issue for barrier options is the frequency with which the asset price is monitored for the purposes of testing whether the barrier has been reached. Often the terms of the contract state that the asset price is observed once a day at the close of trading.

Bermudan options give the holder the right to exercise on multiple but specified dates over the option's life.

Binary options, also called digital options, are characterized by discontinuous payoffs. The option pays a fixed amount if the asset expires above the strike price, and pays nothing if it expires below the strike price. Regardless of how much the settlement price exceeds the strike price, the payoff for a binary option is fixed.

Contingent-premium options are options on which the premium is paid only if the option expires in the money. Because of this feature, these premiums tend to be higher than those for conventional options. The full premium is also paid at expiration, regardless of how in the money the option is. Thus, the premium paid can be significantly higher than the profit returned from the option position.

Installment options are options on which the total premium is paid in installments, with the actual option issued after the final payment. However, the buyer can cancel the payments before any payment date, losing only the premium paid to date and not the full premium amount.

Lookback options, also in the category of path-dependent, give call buyers the right to purchase the security for the lowest price attained during the option's life. Likewise, put sellers have the right to sell the security for the highest price attained during the option's life. The underlying asset in a lookback option is often a commodity. As with barrier options, the value of a lookback can depend on the frequency with which the asset price is monitored.

USES

Options can be used for hedging or speculative purposes. Hedgers can use options to protect against price movements in an underlying instrument or interest-rate exposure. Speculators can use options to take positions on the level of market volatility (if delta-hedged with the underlying instrument) or the direction and scope of price movements in the underlying asset.

The asymmetric payoff profile of an option is a unique feature that makes it an attractive hedging vehicle. For example, an investor with a long position in an underlying asset can buy a put option to offset losses from the long position in the asset if its price falls. In this instance, the investor's position in the asset will be protected at the strike price of the option, and yet the investor will still gain from any rise in the asset's value above the strike price. Of course, this protection against loss combined with the ability to gain from appreciation in the asset's value carries a price—the premium the investor pays for the option. In this sense, the purchase of an option to hedge an underlying exposure is analogous to the purchase of insurance.¹

Options may also be used to gain exposure to a desired market for a limited amount of capital. For instance, by purchasing a call option on a Treasury security, a portfolio manager can create a leveraged position on a Treasury security with limited downside. For the cost of the option premium, the portfolio manager can obtain upside exposure to a movement in Treasury rates on the magnitude of the full underlying amount.

Many banks sell interest-rate caps and floors to customers. Banks also frequently use caps and floors to manage their assets and liabilities. Caps and floors are essentially OTC interest-rate options customized for a borrower or lender. Most caps and floors reference LIBOR (and thus are effectively LIBOR options). Eurodollar options are essentially the exchange-traded equivalent of caps and floors.

1. Note that the investor's position in this example, a long position in the underlying asset and a purchased put option, has exactly the same payoff profile as a position consisting of only a purchased call option. This example illustrates the ability to combine options and the underlying asset in combinations that can replicate practically any desired payoff profile. For example, a purchased call combined with a written put, both with the same exercise price, have the same exposure profile as a long position in the underlying asset.

A cap, which is written independent of a borrowing arrangement, acts as an insurance policy by capping the borrower's exposure (for a fee, the option premium) to higher borrowing costs if interest rates rise. This is equivalent to the cap writer selling the purchaser a call on interest rates. Above the cap rate, the purchaser is entitled to remuneration from the cap writer for the difference between the higher market rate and the cap rate. Often caps have a sequence of (three-month) expiration dates. Each of these three-month pieces is known as a *caplet*. A bank looking to ensure that it does not pay above a specified rate on its LIBOR-based liabilities can achieve this objective by purchasing an interest-rate cap.

A floor is the opposite of a cap and sets a minimum level on interest rates. Thus, it is like a put option on interest rates. If interest rates fall below the floor rate, the purchaser is entitled to remuneration from the floor writer for the difference between the lower market rate and the floor rate. An asset manager with floating-rate LIBOR assets can purchase a floor to ensure that his or her return on the asset does not fall below the level of the floor.

An option strategy consisting of selling a floor and buying a cap is referred to as an interest-rate collar. Collars specify both the upper and lower limits for the rate that will be charged. It is usually constructed so that the price of the cap equals the price of the floor, making the net cost of the collar zero. Caps and floors are also linked to other indexes such as constant maturity Treasury rates (CMT), commercial paper, prime, 11th District Cost of Funds Index (COFI), and Treasury bills.

DESCRIPTION OF MARKETPLACE

Options trade both on exchanges and OTC. The vast majority of exchange options are American, while most OTC options tend to be European. Exchange-traded (or simply traded) options are generally standardized as to the underlying asset, expiration dates, and exercise prices. OTC options are generally tailored to meet a customer's specific needs.

Banks, investment banks, and certain insurance companies are active market makers in OTC options. End-users of options include banks, money managers, hedge funds, insurance

companies, corporations, and sovereign institutions.

PRICING

In terms of valuation and risk measurement, instruments with option characteristics differ significantly from other assets. In particular, options require an assessment of the probability distribution of possible movements in the relevant market-risk factors. Changes in the expected volatility of an instrument's price will affect the value of the option. Option values not only vary with the degree of expected volatility in the price of the underlying asset, but also vary with the price of the underlying in a decidedly asymmetric way.

Although the supply and demand for options is what directly determines their market prices, option valuation theory plays a crucial role in informing market participants on both sides of the market. A number of valuation techniques are used by market participants and are described below.

Approaches to Option Valuation

Black-Scholes

The "standard" model used to value options is the Black-Scholes option pricing model. Based on a few key assumptions—including that asset prices follow a "random walk" (they fluctuate randomly up or down), the risk-free interest rate remains constant, and the option can be exercised only at expiration—the Black-Scholes model can incorporate all the main risk concepts of options and, therefore, provides a useful basis for discussion. In practice, many financial institutions use more sophisticated models, in some cases proprietary models.

The Black-Scholes formula for the value of a call option depends on five variables: (1) the price of the underlying asset, (2) the time to expiration of the option, (3) the exercise price, (4) the risk-free interest rate (the interest rate on a financial institution deposit or a Treasury bill of the same maturity as the option), and (5) the asset's expected volatility. Of the five variables, only four are known to market participants. The asset price and the deposit or Treasury bill rate of the appropriate maturity can be ascertained

from dealers or a public information source. The maturity of the option and the strike price are known from the terms of the option contract.

Assuming that the price of an asset follows a random walk, Black and Scholes derived their formula for pricing a call option on that asset given the current spot price (S_t) at time t , the exercise price (X), the option's remaining time to maturity (T), the probability distribution (standard deviation) of the asset price (σ), and a constant interest rate r . Specifically, the price C at time t of a call option with a strike price of X which matures at time T is—

$$C(S_t, t; X, T, \sigma, r) = S_t N(d + \sigma \sqrt{T - t}) - X e^{-r(T - t)} N(d),$$

where $N(d)$ is the probability that a standardized normally distributed random variable takes on a value less than d , and

$$d = \frac{\ln(S_t/X) + (r - \sigma^2/2)(T - t)}{\sigma \sqrt{T - t}}.$$

The easiest way to understand this formula is as the present value of the expected difference between the future value of the underlying asset and the exercise price, adjusted for the probability of exercise. In other words, it is the expected value of the payoff, discounted to the present at the risk-free rate. The first term in the Black-Scholes equation is the present value of the expected asset price at expiration given that the option finishes in the money. The standard normal term, $N(d)$, is the probability that the option expires in the money; hence, the entire second term, $X e^{-r(T - t)} N(d)$, is the present value of the exercise price times the probability of exercise.

The key unknown in the formula is future volatility of the underlying asset price. There are two ways of estimating this price. First, it can be estimated directly from historical data on the asset price, for example, by calculating the standard deviation of daily price changes over some recent period. When calculating volatility using historical prices, different estimates of volatility may be arrived at (and consequently, also different estimates of an option's value), depending on the historical period chosen and other factors. Hence, the historical period used in volatility estimates should be chosen with some care.

Alternatively, volatility can be estimated by using the Black-Scholes formula, together with the market prices of options, to back out the estimate of volatility implicit in the market price of the option, given the four known variables. This is called the implied volatility of the option. Note that the use of implied volatility may not be appropriate for thinly traded options due to the wide variation of options prices in thin markets.

Some institutions use a combination of both historical and implied volatilities to arrive at an appropriate estimate of expected volatility. Examiners should determine if management and the traders understand the benefits and shortcomings of both the estimated implied volatility and historical methods of calculating volatility, considering that the values derived under either or both methods may be appropriate in certain instances and not appropriate in others. In any case, the method used to estimate volatility should be conservative, independent of individual traders, and not subject to manipulation in risk and profitability calculations. The last point is especially important because volatilities are a critical component for calculating option values for internal control purposes.

Other Closed-Form Models

Since the publication of Black-Scholes, other widely-used formula-based valuation techniques have been developed for use by market makers to value European options as well as options on interest-bearing assets. These techniques include the Hull and White model and the Black, Derman, and Toy (BDT) model. These models are often described as *no-arbitrage models* and are designed so that the model is, or can be made, consistent with the current term structure of interest rates. Other models, such as the Cox, Ingersoll, and Ross (CIR) model, apply other disciplines to the term structure but allow prices to evolve in a way that need not be consistent with today's term structure of interest rates.

Binomial Model

An alternative technique used to value options is the binomial model. It is termed "binomial" because it is constructed as a "tree" of successive event points in which each branch has two possible events: the asset price either rises or

falls. The amount of the rise or fall at each event point depends on the volatility of the underlying asset price. Each path of the variable—from the valuation date through each event point until expiration—then leads to an ultimate profit or loss for the option holder. The value of the option is then the "average" present value of these various ultimate outcomes.

The binomial approach is attractive because it is capable of pricing a wider variety of options than Black-Scholes. For example, a binomial model can allow for a different value function to be applied at different points in time or for options with multiple exercise dates. The binomial model is used by some to value options because it is perceived to be a more reasonable representation of observed prices in particular markets. It is also used to check the accuracy of modifications to the Black-Scholes model. (The Ho-Lee model of interest-rate options, for example, is an elaboration of a binomial model.) In addition, although it requires more computing time than the Black-Scholes model, the binomial model can be more easily adapted for computer use than other still more rigorous techniques. Under the same restrictive assumptions described above, the binomial model and the Black-Scholes formula will produce identical option values.

Monte Carlo Simulations

A final approach to valuing options is simply to value them using a large sample of randomly drawn potential future movements in the asset price, and calculate the average or expected value of the option. The random draws are based on the expected volatility of the asset price so that a sufficiently large sample will (by the Law of Large Numbers) accurately portray the expected value of the option, considering the entire probability distribution of the asset price.

The advantage of this technique is that it allows for different value functions under different conditions, particularly if the value of an instrument at a point in time depends in part on past movements in market-risk factors. Thus, for example, the value of a collateralized mortgage obligation security at a point in time will depend in part on the level of rate-motivated mortgage prepayments that have taken place in the past, making Monte Carlo simulation the valuation technique market participants prefer. Because of the time and computer resources required, this

technique is generally reserved for the most complex option valuation problems.

Sensitivity of Market Risk for Options

Given the complexity of the market risk arising from options, and the different models of option valuation, a set of terms has evolved in the market and in academic literature that now serves as a common language for discussing options risk. The key terms (loosely known as “the greeks”) are described below. Each term is linked to one of the key variables needed to price an option, as described earlier; however, there is no “greek” for the exercise price.

Delta and Gamma

Delta and gamma both describe the sensitivity of the option price with respect to changes in the price of the underlying asset. The delta of an option is the degree to which the option’s value will be affected by a (small) change in the price of the underlying instrument. As such, the estimate of an instrument’s delta can be used to determine the appropriate option hedge ratio for an unhedged position in that instrument.

Gamma refers to the degree to which the option’s delta will change as the instrument’s price changes. The existence of gamma risk means that the use of delta hedging techniques is less effective against large changes in the price of the underlying instrument. While a delta-hedged short option position is protected against small changes in the price of the underlying asset, large price changes in either direction will produce losses (though of smaller magnitude than would have occurred had the price moved against a naked written option).

Vega

The vega of an option, or a portfolio of options, is the sensitivity of the option value to changes in the market’s expectations for the volatility of the underlying instrument. An option value is heavily dependent upon the expected price volatility of the underlying instrument over the life of the option. If expected volatility increases, for example, there is a greater probability that an

option may become in the money (profitable for the holder to exercise); thus the vega is typically positive. As noted above, market participants rely on implied rather than historical volatility in this type of analysis and measurement.

Theta

The theta of an option, or a portfolio of options, is the measure of how much an option position’s value changes as the option moves closer to its expiration date (simply with the passage of time). The more time remaining to expiration, the more time for the option to become profitable to the holder. As time to expiration declines, option values tend to decline.

Rho

The rho of an option, or a portfolio of options, is the measure of how much an option’s value changes in response to a change in short-term interest rates. The impact of rho risk is more significant for longer-term or in-the-money options.

HEDGING

Financial institutions using options may choose from basically three hedging approaches:

1. hedging on a “perfectly matched” basis,
2. hedging on a “matched-book” basis, and
3. hedging on a portfolio basis.

Hedging on a Perfectly Matched Basis

Some financial institutions prefer to trade and hedge options on a perfectly matched basis. In this instance, the financial institution arranges an option transaction only if another offsetting option transaction with exactly the same specifications (that is to say, the same underlying asset, amount, origination date, and maturity date) is simultaneously available. The trade-off in trading options on a perfectly matched basis is that the financial institution may miss opportunities to enter into deals while it is waiting to find the perfect match. However, many risks are reduced or eliminated when options and other

instruments are traded on a perfectly matched basis. In any event, the financial institution continues to assume credit risk when hedging on a perfectly matched basis.

Hedging on a Matched-Book Basis

As a practical matter, managing a portfolio of perfectly matched transactions is seldom possible because of the difficulty in finding two customers with perfectly offsetting needs. Less than perfectly matched hedging, called matched-book hedging, attempts to approximate the perfectly matched approach. In matched-book hedging, all or most of the terms of the offsetting transactions are close but not exactly the same, or transactions are booked “temporarily” without an offsetting transaction.

For example, a financial institution may enter into an option transaction with a customer even if an offsetting OTC option transaction with similar terms is not available. The financial institution may temporarily hedge the risk associated with that option by using futures and exchange-traded options or forward contracts. When an appropriate offsetting transaction becomes available, the temporary hedge is unwound. In reality, it may be some time before an offsetting transaction occurs, and it may never occur. Typically, institutions that run a matched book establish position limits on the amount of residual exposure permitted. By offering transactions on a matched-book basis, financial institutions are able to assist their customers without waiting for a counterparty with simultaneous offsetting needs to appear.

Hedging on a Portfolio Basis

More sophisticated institutions usually find it more practical to hedge their exposure on a portfolio basis when they trade options (and other traded instruments) in more liquid markets, such as those for interest rates and foreign exchange. Portfolio hedging does not attempt to match each transaction with an offsetting transaction, but rather attempts to minimize and control the residual price exposure of the entire portfolio.

Risk-management or hedging models determine the amount of exposure remaining in the portfolio after taking into consideration offsetting transactions currently in the book. Offsetting transactions using futures, swaps, exchange-traded options, the underlying asset, or other transactions are then entered into to reduce the portfolio’s residual risk to a level acceptable to the institution. Portfolio hedging permits financial institutions to act more effectively as market makers for options and other traded instruments, entering into transactions as requested by customers. It is also more efficient and less costly than running a matched book since there is less need to exactly match the particulars of a transaction with an offsetting position.

RISKS

Credit Risk

One of the key risks in an option transaction is the risk that the counterparty will default on its obligation to perform.² Accordingly, credit risk arises when financial institutions purchase options, not when they write (sell) options. For example, when a financial institution sells a put or call option, it receives a premium for assuming the risk that it may have to perform if the option moves in the money and the buyer chooses to exercise. On the other hand, when a financial institution purchases a put or call option, it is exposed to the possibility that the counterparty may not perform if the option moves in the money.

When estimating the credit risk associated with an option contract, some institutions calculate credit risk under a worst-case scenario. To develop this scenario, financial institutions typically rely on statistical analysis. In essence, the financial institution attempts to project, within a certain confidence level, how far, in dollar terms, the option can move in the money. This amount represents the “maximum potential loss exposure” if the counterparty (option seller) defaults on the option contract and the financial institution is required to replace the transaction in the market. For a discussion of other ways financial institutions measure credit risk, see

2. This discussion of credit risk is relevant for over-the-counter products. Exchange-traded options are guaranteed by a clearing organization and have minimal credit risk.

section 2020.1, “Counterparty Credit and Pre-settlement Risk.”

Settlement Risk

The importance of settlement risk may vary materially among countries, depending on the settlement procedures used. In the United States, for example, transactions are typically settled on a net payment basis, with payment being made to only one party to the contract. The beneficiary of the payment incurs the credit risk that the counterparty will not make payment and will default, but does not face the greater settlement risk that a one-sided exchange of securities will occur. Examiners should determine what settlement procedures are used by the markets in which the financial institution participates and should determine what procedures the financial institution takes to minimize any settlement risk. For further discussion of settlement-risk issues, see section 2020.1, “Counterparty Credit and Pre-settlement Risk.”

Liquidity Risk

The financial institution’s ability to offset or cancel outstanding options contracts is an important consideration in evaluating the usefulness and safety and soundness of its options activities. OTC options contracts are often illiquid since they can only be canceled by agreement of the counterparty. If the counterparty refuses to cancel an open contract, the financial institution must either find another party with which to enter an offsetting contract or go to one of the exchanges to execute a similar, but offsetting, contract. On the other hand, if a counterparty defaults and the financial institution is unable to enter into an offsetting contract because of market illiquidity, then the default will expose the financial institution to unexpected market risk.

Exchanges also do not ensure liquidity. First, not all financial contracts listed on exchanges are heavily traded. While some contracts have greater trading volume than the underlying cash markets, others trade infrequently. In addition, even with actively traded futures and options contracts, the bulk of trading occurs in the first or second expiration month. Thus, to be able to offset open contracts quickly as needs change, the financial institution must take positions in

the earlier expiration months when the bulk of trading occurs.

Some exchange-traded contracts limit how far prices can move on any given day. When the market has moved “limit up” or “limit down” for the day, trading ceases until the next day. These limits cause illiquidity in certain instances. Hedging contracts with such limited price-movement potential may not adequately protect the holders against large changes in the value of underlying asset prices. Examiners should review the financial institution’s policies and procedures to determine whether the financial institution recognizes problems that these limits could create (for example, ineffective hedges). This review should also determine whether the financial institution has contingency plans for dealing with such situations.

ACCOUNTING TREATMENT

The accounting treatment for option contracts is determined by the Financial Accounting Standards Board’s Statement of Financial Accounting Standards No. 133 (FAS 133), “Accounting for Derivatives and Hedging Activities,” as amended by Statement of Financial Accounting Standards Nos. 137 and 138 (FAS 137 and FAS 138). (See section 2120.1, “Accounting,” for further discussion.)

Purchased Options

The purchaser of an option has the right, but not the obligation, to purchase a fixed amount of the underlying instrument according to the terms of the option contract. If a purchased option is held as a trading asset or otherwise does not qualify for hedge accounting, it should be marked to market. Options that qualify for hedge accounting should record unrealized gains and losses in the appropriate period to match the recognition of the revenue or expense item of the hedged item. The premium paid on options qualifying as hedges generally are amortized over the life of the option.

Written Options

The writer of an option is obligated to perform according to the terms of the option contract. Written options are generally presumed to be

speculative and, therefore, should be marked to market through the income statement.

RISK-BASED CAPITAL WEIGHTING

The credit-equivalent amount of an option contract is calculated by summing—

1. the mark-to-market value (positive values only) of the contract and
2. an estimate of the potential future credit exposure over the remaining life of each contract.

The conversion factors are listed below.

<i>Remaining maturity</i>	<i>Interest rate</i>	<i>Exchange rate</i>
One year or less	0.00%	1.00%
Five years or less	0.50%	5.00%
Greater than five years	1.50%	7.5%

If a bank has multiple contracts with a counterparty and a qualifying bilateral contract with the

counterparty, the bank may establish its current and potential credit exposures as net credit exposures. (See section 2110.1, “Capital Adequacy.”)

LEGAL LIMITATIONS FOR BANK INVESTMENT

Options are not considered investment securities under 12 USC 24 (seventh). However, the use of these contracts is considered to be an activity incidental to banking within safe and sound banking principles.

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GENERAL DESCRIPTION

A currency swap is a private over-the-counter (OTC) contract which commits two counterparties to exchange, over an agreed period, two streams of interest payments denominated in different currencies, and, at the end of the period, to exchange the corresponding principal amounts at an exchange rate agreed upon at the start of the contract. The term “currency swap” can sometimes be used to refer to foreign-exchange swaps. Foreign-exchange swaps refers to the practice of buying or selling foreign currency in the spot market and simultaneously locking in a forward rate to reverse that transaction in the future. Foreign-exchange swaps, unlike currency swaps, do not involve interest payments—only principal amounts at the start and maturity of the swap.

CHARACTERISTICS AND FEATURES

The term “currency swap” is used to describe interest-rate swaps involving two currencies. The strict application of the term is limited to fixed-against-fixed interest-rate swaps between currencies. Cross-currency swaps, a generic variation of the currency swap, involve an exchange of interest streams in different currencies, at least one of which is at a floating rate of interest. Those swaps that exchange a fixed rate against a floating rate are generally referred to as cross-currency coupon swaps, while those that exchange floating-against-floating using different reference rates are known as cross-currency basis swaps.

Other types of cross-currency swaps include annuity swaps, zero-coupon swaps, and amortizing swaps. In cross-currency annuity swaps, level cash-flow streams in different currencies are exchanged with no exchange of principal at maturity. Annuity swaps are priced such that the level payment cash-flow streams in each currency have the same net present value at the inception of the transaction. Annuity swaps are often used to hedge the foreign-exchange exposure resulting from a known stream of cash flows in a foreign currency. For example, a U.S. corporation which receives a deutschemark (DM)

2 million semiannual dividend payment from its German subsidiary can execute an annuity swap with a dealer in which it will make semiannual payments of DM 2 million and receive semi-annual payments of \$300,000—thus locking in a dollar value of its DM-denominated dividend payments.

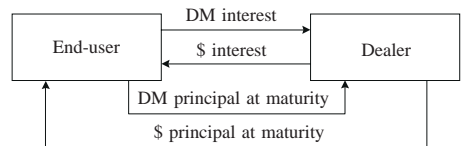
A zero-coupon swap involves no periodic payments (representing “coupon” payments). Rather, these cash flows are incorporated into the final exchange of principal. Cross-currency zero-coupon swaps are equivalent to a long-dated forward contract and are used to hedge long-dated currency exposures when the exchange-traded and OTC foreign-exchange market may not be liquid.

An amortizing cross-currency swap is structured with a declining principal schedule, usually designed to match that of an amortizing asset or liability. Amortizing cross-currency swaps are typically used to hedge a cross-border project-financing loan in which the debt is paid down over a series of years as the project begins to generate cash flow.

Plain Vanilla Example

Figure 1 illustrates the most simple example of a currency swap. An institution enters into a currency swap with a counterparty to exchange U.S. dollar interest payments and principal for offsetting cash flows in German DM.

Figure 1—Plain Vanilla Currency Swap



As illustrated, there are three stages to a currency swap. The first stage is an initial exchange of principal at an agreed rate of exchange, usually based on the spot exchange rate. The initial exchange may be on either a *notional basis* (no physical exchange of principal) or a *physical exchange* basis. The initial exchange is

important primarily to establish the quantity of the respective principal amounts for the purpose of calculating the ongoing payments of interest and for the re-exchange of principal amounts under the swap. Most commonly, the initial exchange of principal is on a notional basis.

The second stage involves the exchange of interest. The counterparties exchange interest payments based on the outstanding principal amounts at the respective fixed interest rates agreed on at the outset of the transaction. The third stage entails the re-exchange of principal. On maturity, the counterparties re-exchange principal at the original exchange rate agreed on at the execution of the swap.

USES

Currency swaps create exposures to the risk of changes in exchange rates and interest rates. Therefore, they can be used to take risk positions based on expectations about the direction in which the exchange rate, interest rates, or both will move in the future. Firms can alter the exposures of their existing assets or liabilities to changes in exchange rates by swapping them into foreign currency. Also, a reduction in borrowing costs can be achieved by obtaining more favorable financing in a foreign currency and using currency swaps to hedge the associated exchange-rate risks. Conversely, a firm can enhance the return on its assets by investing in the higher-yielding currency and hedging with currency swaps.

DESCRIPTION OF MARKETPLACE

Market Participants

Sell Side

Most of the major international financial institutions are willing to enter into currency swaps. However, the group of those institutions acting as market makers (that is, quoting firm buying and selling prices for swaps in all trading conditions) is limited to a handful of the most active swap participants who make markets for interest-rate swaps in the major currencies. Even this group is focused largely on swaps involving U.S. dollar LIBOR as one of the legs. Further-

more, because of the credit risk involved, many customers prefer only to deal with the highest-rated institutions. In fact, most of the investment banking dealers book these swaps in special-purpose, “AAA”-rated, derivative product subsidiaries.

Buy Side

The end-users of currency swaps are mainly financial institutions and corporations. These firms can enter into a swap either to alter their exposures to market risk, enhance the yields of their assets, or lower their funding costs.

Quoting Conventions

Currency swaps are generally quoted in terms of all-in prices, that is, as absolute annual fixed percentage interest rates. Swap intermediaries may quote two all-in prices for each currency swap, for example, 6.86–6.96 percent for the U.S. dollar leg and 7.25–7.35 percent for the DM leg. This is a two-way price, meaning a dual quotation consisting of a buying and selling price for each instrument. The terms buying and selling can be ambiguous in the case of swaps; the terms paying and receiving should be used instead. In currency swaps, that is, fixed-against-fixed swaps, both sides of the swap should be specified. It may not be obvious which side of a two-way price is being paid and which is being received.

Trading

Since the market for currency swaps is a highly customized OTC market, most of the trading is done by telephone. In negotiating swaps, key financial details are agreed on orally between dealers. Key details are confirmed in writing.

In the early days of the swaps market, intermediaries tried to avoid the risk of acting as principals by acting as arrangers of swap deals between end-users. Arrangers act as agents, introducing matching counterparties to each other and then stepping aside. Arrangers were typically merchant and commercial banks. Arrangement continues to be a feature of currency swaps. Brokers act as agents, arranging deals by matching swap counterparties, but they do not

participate in the actual transactions. Brokers do not earn dealing spreads, but are paid a flat fee based on the size of the deal. Brokers disclose indicative swap price information over networks such as Reuters and Telerate.

The market for currency swaps has become more complex and diverse. Commercial banks have begun entering this market as principal intermediaries to provide their expertise in assessing credit risk to end-users of swaps. Many end-users lack credit analysis facilities and prefer having credit exposure to a large financial intermediary rather than to another end-user counterparty. However, in several cases, the credit rating of the financial intermediary is not strong enough for a particular end-user. For this reason, a large number of these swaps are booked in the AAA subsidiaries.

The secondary market for currency swaps is more limited than the market for single-currency interest-rate swaps due to the credit risk involved. There are cases in which a buyer of a swap has assigned it to a new counterparty (that is, the buyer substitutes one of the original counterparties). Recently, assignment has been by novation, meaning that the swap contract to be assigned is in fact terminated and a new but identical contract is created between the remaining counterparty and the assignee.

Market Transparency

A large volume of currency swaps consists of customized transactions whose pricing is sensitive to credit considerations. Consequently, the actual pricing of these swaps is less transparent than it is for single-currency interest-rate swaps. Price information is distributed over screen-based communication networks, such as Reuters and Telerate, but this consists primarily of broker's indicative prices for plain vanilla cross-currency transactions.

PRICING

A currency swap is valued as the present value (PV) of the future interest and principal payments in one currency against the PV of future interest and principal payments in the other currency, denominated in the same currency:

$$PV_{\text{currency A cash flow}} - \frac{PV_{\text{currency B cash flow}}}{\text{Exchange rate}_{B/A}} =$$

The cash flows above (the streams of interest and principal payments) are functions of the current market exchange rate, which is used to translate net present values into the same currency, and the current market interest rates, which are used to discount future cash flows.

Calculating the present value of the stream of fixed interest payments is done as follows:

$$PV_{\text{fixed interest + principal}} = \sum_{n=1}^N \frac{C_n}{V^n} + \frac{P}{V^n},$$

- where $V^n = [1 + (\text{day count}/360 \times I)]^n$
- and C_n = fixed interest cash flow at time n
- P = principal cash flow
- I = prevailing annual market interest rate
- N = years to maturity
- n = settlement period number
- day count = number of days between regular coupon payments

For example, a \$/DM currency swap is used with these specifications:

- Remaining life = 3 years
- \$ fixed interest rate = 5% APR
- DM fixed interest rate = 9% APR
- \$ principal = \$100 million
- DM principal = DM 170 million
- Agreed-upon swap exchange rate = 1.700 DM/\$
- Current prevailing rates:
 - 3-year DM interest rate = 8% APR
 - 3-year \$ interest rate = 6% APR
- Spot exchange rate = 1.5 DM/\$

The PV of the deutschemark part of the transaction would be—

$$PV = \text{DM } 174,381,065.$$

To find the PV of the dollar cash flow, the following constants are known:

- $N = 3$ (years)
- $I = 6\%$ APR

such that—

$$PV = \$97,326,988.$$

The value of the swap is the difference between the *PVs* of the deutschemark and dollar cash flows. To calculate the difference, first convert the DM leg to dollar amounts, using the spot exchange rate of 1.5:

$$\begin{aligned} (\text{DM } 174,381,065 / 1.50) &= \$116,254,043 \\ - \$97,326,988 &= \$18,927,055. \end{aligned}$$

The pricing of currency swaps is similar to that used for interest-rate swaps, with the difference that the exchange rate has to be accounted for in assessing cash flows. A currency swap in which the two counterparties are both paying fixed interest should have a net present value of zero at inception. The fixed interest rate is set at inception accordingly. For a cross-currency swap in which at least one side is paying a floating interest rate, implied forward interest rates are used to price the swap.

HEDGING

Currency swaps are used to manage interest-rate risk and currency risk. A company with mainly deutschemark revenues that has borrowed fixed-rate dollars is faced with the prospect of currency appreciation or depreciation, which would affect the value of its interest payments and receipts. In this example, the prospect of a dollar appreciation would mean that the DM revenue would have to increase in order to raise enough (stronger) dollars to repay the fixed-rate (dollar) loan. The German firm could hedge its exposure to the appreciating dollar by entering into a DM/\$ currency swap.

Furthermore, if the German company expects not only that the dollar will appreciate but that German interest rates will fall, then a cross-currency swap could be used. The German firm could swap fixed-rate dollars for floating-rate marks to take advantage of the expected fall in German interest rates, as well as hedge against exchange-rate risk.

In the example above, initial exchange of principal is not needed. Exchange of principal is needed only when a swap counterparty needs to acquire foreign currency or needs to convert new borrowing from one currency to another. If

the foreign currency of a liability is expected to depreciate (in the example above, if the dollar is expected to depreciate) or the domestic currency is expected to appreciate, a currency swap would restrict currency gains. In such cases, the only risk that would need to be hedged against would be interest-rate risk, in which case engaging in a domestic currency interest-rate swap would be appropriate. (In these hedges, assumptions must be made about the movement of the exchange rate. The swap counterparty is still exposed to exchange-rate risk, but is hedging only interest-rate risk based on an assumption about the exchange rate.)

RISKS

Market Risk

A currency swap that is not hedged or used as a hedge exposes the institution to dual market risks: exchange-rate risk and interest-rate risk. Exchange-rate risk refers to movements in the prices of a swap's component parts (specifically, the spot rate), while interest-rate risk is caused by movements in the corresponding market interest rates for the two currencies.

Liquidity Risk

As stated earlier, the market for currency swaps is confined to a small number of institutions and is very credit intensive. Reversing out of a trade at short notice can be very difficult, especially for the more complicated structures. Occasionally, an institution can go to the original counterparty, resulting in the cancellation or novation of the trade, which frees up credit limits needed for some other transaction.

Credit Risk

Credit risk in currency swaps may be particularly problematic. Whereas interest-rate swaps involve the risk of default on interest payments only, for currency swaps, credit and settlement risk also extends to the payment of principal. The consequences of an actual default by a currency-swap counterparty depends on what the swap is being used for. If the currency swap is being used to hedge interest-rate and currency

risk, the default of one counterparty would leave the other counterparty exposed to the risk being hedged. This could translate into an actual cost if any of those risks are actually realized. If the swap is held to take advantage of expected rate movements, the default of a counterparty would mean that any potential gains would not be realized.

If a bank has multiple contracts with a counterparty and a qualifying bilateral contract with the counterparty, the bank may establish its current and potential credit exposures as net credit exposures. (See section 2110.1, "Capital Adequacy.") For institutions applying market-risk capital standards, all foreign-exchange transactions are included in value-at-risk (VAR) calculations for general market risk.

ACCOUNTING TREATMENT

The accounting treatment for foreign-currency transactions, including currency swaps, is determined by the Financial Accounting Standards Board's Statement of Financial Accounting Standards No. 133 (FAS 133), "Accounting for Derivatives and Hedging Activities," as amended by Statement of Financial Accounting Standards Nos. 137 and 138 (FAS 137 and FAS 138). (See section 2120.1, "Accounting," for further discussion.)

RISK-BASED CAPITAL WEIGHTING

The credit-equivalent amount of a currency-swap contract is calculated by summing—

1. the mark-to-market value (positive values only) of the contract and
2. an estimate of the potential future credit exposure over the remaining life of each contract.

The conversion factors are listed below.

<i>Remaining maturity</i>	<i>Credit-conversion factor</i>
One year or less	1.00%
Five years or less	5.00%
Greater than five years	7.50%

LEGAL LIMITATIONS FOR BANK INVESTMENT

Currency swaps are not considered investments under 12 USC 24 (seventh). However, the use of currency swaps is considered to be an activity incidental to banking, within safe and sound banking practices.

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GENERAL DESCRIPTION

Options on swap contracts (swaptions) are over-the-counter (OTC) contracts providing the right to enter into an interest-rate swap. In exchange for a one-time, up-front fee, the buyer of the swaption has the right, but not the obligation, to enter into a swap at an agreed-on interest rate at a specified future date for an agreed-on period of time and interest rate. As such, swaptions exhibit all of the same characteristics inherent in options (including asymmetric risk-return profiles).

In general, an interest-rate call swaption gives the purchaser the right to receive a specified fixed rate, the strike rate, in a swap and to pay the floating rate for a stated time period. (In addition to interest rates, swaptions can be traded on any type of swap, such as currencies, equities, and physical commodities.) An interest-rate put swaption gives the buyer the right to pay a specific fixed interest rate in a swap and to receive the floating rate for a stated time period. Conversely, the writer of a call swaption sells the right to another party to receive fixed (the writer will thus be obligated to pay fixed if the option is exercised), while the writer of a put swaption sells the right to another party to pay fixed (the writer will thus be obligated to receive fixed if the option is exercised).

CHARACTERISTICS AND FEATURES

Swaptions are typically structured to exchange a stream of floating-rate payments for fixed-rate payments in one currency. The fixed rate is identified as the strike yield and is constant throughout the life of the swaption, while floating rates are based on a variety of indexes including LIBOR, Eurodollar futures, commercial paper, and Treasury bills.

The swap component of a swaption is not restricted to the fixed versus floating format. As with simple swaps, the structure of swaptions may vary. For a discussion of swap variations, see section 4325.1, “Interest-Rate Swaps.”

Swaption maturities are not standardized, as all swaptions are OTC transactions between the

buyer and the seller. Maturities for swaptions typically range from one month to two years on the option and up to 10 years on the swap. The option component of the swaption can be designated to be exercised only at its expiration date (a European swaption—the most common type), on specific prespecified dates (a Bermudan swaption), or at any time up to and including the exercise date (an American swaption).

Swaptions are generally quoted with references to both the option and swap maturity. For example, a quote of “3 into 5” references a 3-year option into a 5-year swap, for a total term of eight years. Terms can be arranged for almost any tenor from a 3-month to a 10-year option, or even longer. In general, the 5-year into 5-year swaption might be considered the end of the *very* liquid market. Longer-tenor instruments (for example, 10-year into 20-year) are not uncommon but do not display the same degree of liquidity. As with options, active swaption dealers are really speculating on volatility more than market direction.

Important Variations

Cancelable Swaps

Cancelable (callable or putable) swaps are popular types of swaptions. In exchange for a premium, a callable swap gives the fixed-rate payor the right, at any time before the strike date, to terminate the swap and extinguish the obligation to pay the present value of future payments. A putable swap, conversely, gives the fixed-rate receiver the right to terminate the swap. (In contrast, a counterparty in a plain vanilla swap may be able to close out a swap before maturity, but only by paying the net present value of future payments.) Cancelable swaptions are typically used by institutions that have an obligation in which they can repay principal before the maturity date on the obligation, such as callable bonds. Cancelable swaps allow companies to avoid maturity mismatches between (1) assets and liabilities with prepayment options and (2) the swaps put in place to hedge them. A “3x5 cancelable swap” would describe a five-year swap that may be terminated by one of the counterparties after three years.

Extendible Swaps

In exchange for a premium, extendible swaps allow the owner of the option to extend the tenor of an already-existing swap. If a firm has assets or liabilities whose maturities are uncertain, an extendible swap allows the investor to hedge the associated price risk more precisely.

Amortizing or Accreting Swaptions

Two additional instruments, amortizing and accreting swaptions, are useful for real estate-related or project-finance-related loans. Amortizing and accreting swaptions represent options to enter into an amortizing or accreting swap, where the principal amount used to calculate interest-rate payments in the swap decreases or increases during the life of the obligation. Specifically, the notional amount of the underlying swap decreases (amortizes) or increases (accretes) depending on loan repayments or drawdowns. For example, the swaption can be constructed to give the owner of the option some flexibility in reducing the prepayment risk associated with a loan.

USES

Swaptions are most commonly used to enhance the embedded call option value in fixed-rate callable debt and to manage the call risk of securities with embedded call features. Swaptions may be used to provide companies with an alternative to forward, or deferred, swaps, allowing the purchaser to benefit from favorable interest-rate moves while offering protection from unfavorable moves. Swaptions are also used to guarantee a maximum fixed rate of interest on anticipated borrowing.

Enhancing Embedded Call Option Value in Fixed-Rate Callable Debt

Through a swaption, the bond issuer sells the potential economic benefit arising from the ability to call the bonds and refinance at lower interest rates. This technique, known as “call monetization,” is effectively the sale (or early execution) of debt-related call options. The following example illustrates call monetization.

A firm has \$100 million of 11 percent fixed-rate debt which matures May 15, 2002, and is callable May 15, 1999. The company sells to a bank a \$100 million notional principal European call swaption with a strike yield of 11, an option exercise date of May 15, 1999, and an underlying swap maturity date of May 15, 2002. In return for this swaption, the firm receives \$4 million. The company has sold to the bank the right to enter into a swap to receive a fixed rate of 11 and pay a floating rate. As a result of the sale, the firm’s financing cost is reduced by \$4 million, the amount of the premium. From the bank’s perspective, a fee was paid for the right to receive fixed-rate payments that may be above market yields at the exercise date of May 15, 1999.

If, at May 15, 1999 (the call date), the company’s three-year borrowing rate is 10, the debt will be called and the bank will exercise the call swaption against the firm. The company becomes a fixed-rate payer at 11 percent on a three-year interest-rate swap from May 15, 1999, through May 15, 2002, while receiving the floating rate from the bank. The firm will now attempt to refinance its debt at the same or lower floating rate than it receives from the bank. As long as the floating rate that the company receives does not fall below the firm’s net refinancing cost, the monetization of the call lowers net borrowing costs because the firm starts out paying 11 percent interest and is still paying 11 percent interest, but has received the \$4 million premium.

If, on the other hand, the company’s three-year funding rate, as of May 15, 1999, is 11 percent or higher, the bank will allow the option to expire and the firm will not call the debt. The company will continue to fund itself with fixed-rate debentures at 11 percent, but the \$4 million premium will reduce its effective borrowing cost.

Managing the Call Risk of Securities with Embedded Call Features

Investors also use swaptions to manage the call risks of securities with embedded call features. For example, an investor buys a seven-year \$100 million bond that has a 12 coupon and is callable after five and wishes to purchase protection against the bonds’ being called. Thus, in year four, the investor purchases

from a bank a one-year European call swaption, with a strike yield of 12 percent and a swap maturity of two years based on a notional principal of \$100 million. The firm pays the bank a \$1 million up-front fee for this option. In this case, the higher the strike yield, the higher the up-front fee will be.

At year five, if two-year floating rates are 10 percent, the bond will be called, and the investor will exercise the swaption. The investor will reinvest its money at the current floating rate of 10 percent, pass along the 10 percent interest to the bank, and receive 12 percent from the bank. Thus, the investor guarantees that it will not earn less than 12 percent on its investment. If, on the other hand, two-year floating rates are above 12 percent, the bonds will not be called and the investor will let the option expire.

Guaranteeing a Maximum Interest Rate on Variable-Rate Borrowing

An additional use of swaptions is to guarantee a maximum interest rate on variable-rate borrowing. A company, for example, issues a two-year \$10 million floating-rate note. The firm does not want to pay more than 10 percent interest so it purchases from a bank a one-year European put swaption for the right to enter into a one-year swap in which it will pay a fixed rate (strike yield) of 10 percent on a notional principal of \$10 million. The bank, on the other hand, agrees to pay floating-rate interest payments to the firm if the option is exercised. The company pays the bank an up-front fee of \$100,000 for this option.

At the end of the first year, if the floating rate increases to 12 percent, the firm will exercise the option and pay 10 percent interest to the bank, and the bank will pay the current floating rate of 12 percent to the company. While this option will cost the firm \$100,000, it will save \$200,000 in interest costs $((12 - 10) \times \$10 \text{ million})$. Therefore, in total, the company will save \$100,000. Once the option is exercised, however, the firm cannot return to floating rates even if floating rates should fall below 10 percent (unless the company reverses the swap, which can be very expensive). On the other hand, if the floating rate is below 10 percent at the end of the first year, the firm will let the option expire and continue to pay a floating rate.

DESCRIPTION OF MARKETPLACE

Swaptions are OTC-traded instruments, and they can easily be customized to suit a particular investor's needs. The market is very active and can be loosely coupled with other markets (for example, Eurodollar caps and floors and the OTC bond options market) in certain maturities. In addition, there is a very active secondary market.

In general, U.S. dollar swaptions with an option component of less than five years can be thought of as relatively short-term; the five-year to seven-year maturity is considered medium-term, with ten-year and longer options being considered long-term and displaying relatively more limited liquidity. A tenor such as a ten-year into ten-year swaption can be thought of as the upper bound on the liquid market.

PRICING

The pricing of swaptions relies on the development of models that are on the cutting edge of options theory. Dealers differ greatly in the models they use to price such options, and the analytical tools range from modified Black-Scholes to binomial lattice versions to systems based on Monte Carlo simulations. As a result, bid/ask spreads vary greatly, particularly from more complicated structures that cannot be easily backed off in the secondary markets. The price of a swaption, known as the premium, depends on several factors: the expected shape of the yield curve, the length of the option and swap periods, the strike yield's relationship to market interest rates, and expected interest-rate volatility.

HEDGING

Swaptions are often hedged using Eurodollar futures, Treasuries, and interest-rate swaps. Market participants have introduced a variety of features to mitigate counterparty credit risk, such as cash settlement and posting of cash collateral. Of these, cash settlement, in which the seller pays the net present value of the swap to the buyer upon exercise of the option, has been the most common. Cash settle-

ment has two significant benefits: (1) it limits the length of credit exposure to the life of the option and (2) banks are not required to allocate capital for the swap, since neither party actually enters into the swap.

RISKS

The risks of purchasing or selling a swaption include the price and credit risks associated with both swaps and options. For a more detailed discussion of the risks connected with these instruments, see sections 4325.1 and 4330.1, "Interest-Rate Swaps" and "Options," respectively.

As a hybrid instrument, a swaption generates two important exposures: the probability of exercise and the credit risk emerging from the swap. The first risk is a function of the option's sensitivity to the level and volatility of the underlying swap rates. The swaption's credit risk is the cost to one counterparty of replacing the swaption in the event the other counterparty is unable to perform.

As mentioned earlier, liquidity risk is most pronounced for swaptions with option components of greater than ten years. However, swaptions with five-year option components will have greater liquidity than those with ten-year option components.

ACCOUNTING TREATMENT

The accounting treatment for swaptions is determined by the Financial Accounting Standards Board's Statement of Financial Accounting Standards No. 133 (FAS 133), "Accounting for Derivatives and Hedging Activities," as amended by Statement of Financial Accounting Standards Nos. 137 and 138 (FAS 137 and FAS 138). (See section 2120.1, "Accounting," for further discussion.)

RISK-BASED CAPITAL WEIGHTING

The credit-equivalent amount of a swaption contract is calculated by summing—

1. the mark-to-market value (positive values only) of the contract and
2. an estimate of the potential future credit exposure over the remaining life of each contract.

The conversion factors are listed below:

<i>Remaining maturity</i>	<i>Credit-conversion factor</i>
One year or less	0.00
Five years or less	0.50
Greater than five years	1.50

If a bank has multiple contracts with a counterparty and a qualifying bilateral contract with the counterparty, the bank may establish its current and potential credit exposures as net credit exposures. (See section 2110.1, "Capital Adequacy.")

LEGAL LIMITATIONS FOR BANK INVESTMENTS

Swaptions are not considered investments under 12 USC 24 (seventh). The use of these instruments is considered to be an activity incidental to banking within safe and sound banking practices.

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GENERAL DESCRIPTION

The term “equity derivatives” refers to the family of derivative products whose value is linked to various indexes and individual securities in the equity markets. Equity derivatives include stock index futures, options, and swaps. As in the interest-rate product sector, the over-the-counter (OTC) and futures markets are closely linked. Banks are involved in these markets in a variety of ways, depending on their customer base. Some banks are actively involved as market makers in all products, while others only use this market to satisfy customer needs or as part of a structured financial transaction.

CHARACTERISTICS AND FEATURES

Equity derivatives range in maturity from three months to five years or longer. The maturities in the OTC market are generally longer than those in the futures market. However, maturities in the futures market are gradually changing with the development of the LEAPs (Long-Term Equity Anticipation) market on the exchanges. As with other futures markets, there is a movement towards more flexibility in the maturities and strike prices of equity derivatives.

The following are the major instruments that comprise the equity derivatives market and are available for most major markets around the world:

- *Equity swaps* are transactions in which an exchange of payments referenced to the change in a certain index and an interest rate are exchanged and are usually based on a fixed notional amount. For example, counterparty A may pay a spread over LIBOR to counterparty B and receive the return on a specified equity index. These swaps are documented using standard ISDA documentation. Some of these transactions also have a currency component and in many cases are done as quantos.¹

1. Quantos (guaranteed exchange-rate options/quantity-adjusting options) are cross-border equity or equity index options that eliminate currency-exchange-rate exposure on an option or option-like payout by translating the percentage change in the underlying into a payment in the investor's base

- *Stock index futures* are futures on various stock indexes and are traded on most of the major exchanges.
- *Stock index options* are options on either the cash value of the indexes or on the stock index futures.
- *Equity options* are options on the individual stocks and are also traded on most major exchanges.
- *Warrants* are longer-term options on either individual stocks or on certain indexes. They are popular in Europe and Asia (especially Japan).
- *Equity-index-linked notes* are fixed-income securities issued by a corporation, bank, or sovereign in which the principal repayment of the note at maturity is linked to the performance of an equity index. The formula for principal repayment can reflect a long or short position in an equity index and can also provide an exposure to the equity market which is similar to an option or combination of options.
- *Other instruments* include ADRs (American Depository Receipts), and SPDRs (S&P 500 Depository Receipts).
- *Index arbitrage* is strictly not a product, but an activity; however, it is an important part of the equity derivatives market. As its name implies, index arbitrage is the trading of index futures against the component stocks.

As these markets have developed, various enhancements have been made to them, such as the introduction of futures on individual stocks. Some of the more structured deals that banks are involved in use more than one of the above products.

USES

Equity derivatives are used for investment, hedg-

currency at a spot exchange rate set at the start of the contract. The investor holding a quanto option obtains participation in a foreign equity or index return, denominated in the domestic currency. Currency exchange rates are fixed at issuance by setting the option payoff in the investor's base currency as a multiple of the foreign equity or index rate of return. The rate of return determining the payoff can be positive (calls) or negative (puts). Guaranteed-exchange-rate put options are more common in some markets than guaranteed exchange-rate call options.

ing, and speculative purposes. The growth in this market has coincided with developments in other derivative markets. Users and customers of the banks have shown increased interest in equity derivative products for purposes ranging from hedging to speculation. Some of the major users of these products are investment funds. Some banks also use them to hedge their index-linked certificates of deposit (CDs) (these are longer-term CDs, whose principal is guaranteed and whose yield is linked to the return on a certain stock index, for example, S&P 500). Some corporations also use equity derivatives to lower the yield on their issuance of securities. Some speculators (hedge funds) might use equity swaps or options to speculate on the direction of equity markets.

Equity-index-linked swaps are often used as an overlay to a portfolio of fixed-income assets to create a synthetic equity investment. For example, a portfolio manager may have a fixed-income portfolio whose yield is based on LIBOR. The manager can enter into an equity-index-linked swap with a bank counterparty in which the manager pays the bank LIBOR and receives the return on an equity index, plus or minus a spread. If the portfolio manager earns a positive spread on the LIBOR-based investments, an equity-index-linked swap may result in an overall return which beats the market index to which the portfolio manager is evaluated. For example, if the LIBOR-based portfolio yields LIBOR + 20 basis points, and the manager enters into an equity-index-linked swap in which he or she pays LIBOR flat and receives the return on the equity index flat, the manager will receive a return on the equity index plus 20 basis points, thus outperforming the index. In this way, equity-index-linked swaps allow portfolio managers to transfer expertise in managing one class of assets to another market.

Equity-index options, warrants, and futures are often used as hedging vehicles. A portfolio manager, for example, can protect an existing indexed equity portfolio against a decline in the market by purchasing a put option on the index or by selling futures contracts on the index. In the case of the put option, the portfolio will be protected from a decline in the index, while being able to participate in any future upside movement of the index. The protection of the put option, however, involves the cost of a premium which is paid to the seller of the option. In the case of selling futures contracts on the index, the portfolio is protected against a

decline in the index, but will not be able to participate in future upside movement in the index. Unlike the put option, the futures contract does not involve an up-front payment of a premium.

Equity-linked options are also used by portfolio managers to gain exposure to an equity market for a limited amount of capital. For instance, by purchasing a call option on an equity index, a portfolio manager can create a leveraged position in an equity index with limited downside. For the cost of the option premium, the portfolio manager will obtain upside exposure to an equity market on the magnitude of the full underlying amount.

DESCRIPTION OF MARKETPLACE

Sell Side

The major sell-side participants in this market can be divided into three groups: investment banks, exchanges, and commercial banks. Investment banks have the greatest competitive advantages in these markets because of their customer base and the nature of their businesses and, therefore, have the largest market share. While commercial banks have much of the necessary technical expertise to manage these instruments, they are hampered by regulations and lack of a customer base.

The underlying instruments for equity derivative products are primarily the various stock indexes traded around the world. Even though there is a lot of activity in the individual stock options, banks are mostly active in the derivatives market on the various indexes. Their involvement in the market for individual stocks is affected by various regulations restricting bank ownership of individual equities.

Buy Side

Buy-side participants in the equity derivatives market include money managers; hedge funds; insurance companies; and corporations, banks, and finance companies which issue equity securities. Commercial banks are not very active users of equity derivatives because of regulations restricting bank ownership of equities.

PRICING

Because of the large volumes traded in equity derivatives markets, the pricing of most of these products is very transparent and widely disseminated—at least for the products that are based on the equity markets of the major industrialized countries. This transparency does not hold true for the prices in some of the developing countries or in those countries that are highly regulated. The pricing of some of these products is also affected by tax considerations and regulatory constraints for certain cross-border transactions. As with some of the other derivative markets, there is less transparency for structured products, especially those that involve some of the swaps that include exotic options in both the interest-rate and index components.

HEDGING

Since banks' activities with customers often involve nonstandard maturities and amounts, equity derivatives instruments are often hedged using exchange-traded instruments. The hedges take the form of combinations of the products that are available on the relevant exchanges and also involve the interest-rate markets (swaps and futures) to hedge out the interest-rate risk inherent in equity derivatives.

The risks of individual equity securities or a basket of equity securities are often hedged by using futures or options on an equity index. This hedge may be over- or underweighted based on the expected correlation between the index and the individual security or basket of securities. To the extent that the underlying and the hedge instrument are not correlated as expected, the hedge may not be effective and may lead to incremental market risk on the trade.

RISKS

Market Risk

Market risk in equity derivative products arises primarily from changes in the prices of the underlying indexes and their component stocks. There is also correlation risk associated with hedging certain transactions with the most liquid instrument available, which may be less than

perfectly correlated with the instrument being hedged.

Interest-Rate Risk

Interest-rate risk in equity derivative products can be substantial, especially for those transactions with relatively long maturities. The implied interest rate is a very important component in the calculation of the forward prices of the index. For hedges that use futures to closely match the maturities of the transaction, interest-rate risk is minimized because the price of the future already has an implied interest rate. Interest-rate risk may arise in those transactions in which the maturity of the transaction is longer than the maturity of the hedges that are available. In swap transactions, this mismatch may affect the hedging of implied forward cash flows. In certain cross-border transactions, additional risks arise from the necessity of hedging the nondomestic interest-rate component.

Volatility Risk

A substantial portion of transactions in the equity derivatives market have option components (both plain-vanilla and, increasingly, various exotic types, especially barrier options). In certain shorter-dated transactions, hedges are available on the exchanges. But when the maturity is relatively long, the options may carry substantial volatility risks. These risks may be especially high in certain developing equity markets in which the absolute level of volatility is high and the available hedges lack liquidity.

Liquidity Risk

Liquidity risk is not significant for most equity derivative products in the major markets and for products with maturities of less than a year. Liquidity risk increases for longer maturities and for those transactions linked to emerging markets.

Currency Risk

Currency risk is relevant for cross-border and quanto products. As these transactions are often

dynamically hedged by the market maker, currency risk can be significant when there are extreme movements in the currency.

ACCOUNTING TREATMENT

The accounting treatment for equity derivatives, except those indexed to a company's own stock, is determined by the Financial Accounting Standards Board's Statement of Financial Accounting Standards No. 133 (FAS 133), "Accounting for Derivatives and Hedging Activities," as amended by Statement of Financial Accounting Standards Nos. 137 and 138 (FAS 137 and FAS 138). (See section 2120.1, "Accounting," for further discussion.) Derivatives indexed to a company's own stock can be determined by Accounting Principles Board (APB) Opinion No. 18, "The Equity Method of Accounting for Investments in Common Stock," and FAS 123, "Accounting for Stock-Based Compensation."

RISK-BASED CAPITAL WEIGHTING

The credit-equivalent amount of an equity derivative contract is calculated by summing—

1. the mark-to-market value (positive values only) of the contract and
2. an estimate of the potential future credit exposure over the remaining life of each contract.

The conversion factors are listed below.

<i>Remaining maturity</i>	<i>Credit-conversion factor</i>
One year or less	6.00%
Five years or less	8.00%
Greater than five years	10.00%

If a bank has multiple contracts with a counterparty and a qualifying bilateral contract with the counterparty, the bank may establish its current and potential credit exposures as net credit exposures. (See section 2110.1, "Capital Adequacy.")

LEGAL LIMITATIONS FOR BANK INVESTMENT

Equity derivatives are not considered investments under 12 USC 24 (seventh). A bank must receive proper regulatory approval before it engages in certain types of equity-linked activities.

REFERENCES

- Allen, Julie A., and Janet L. Showers. *Equity-Index-Linked Derivatives, An Investor's Guide*. Salomon Brothers, April 1991.
- Federal Reserve Bank of Chicago. *The Equity Derivatives Market: A Product Summary*. February, 1997.

GENERAL DESCRIPTION

Credit derivatives are off-balance-sheet financial instruments that permit one party (the beneficiary) to transfer the credit risk of a reference asset, which it typically owns, to another party (the guarantor) without actually selling the asset. In other words, credit derivatives allow users to “unbundle” credit risk from financial instruments and trade it separately.

As estimated by dealers, the market for credit derivatives approached \$1 trillion in 2002; default swaps accounted for more than half of the market.

CHARACTERISTICS AND FEATURES

In general, credit derivatives have three distinguishing features:

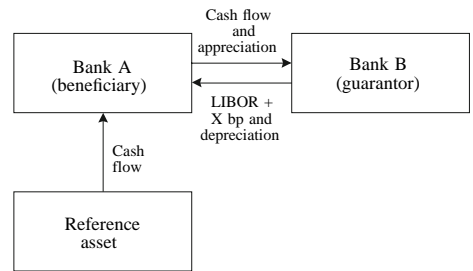
- the transfer of the credit risk associated with a reference asset through the use of contingent payments that are based on events of default and, usually, on the prices of instruments before, at, and shortly after default (a reference asset is most often a traded sovereign and corporate debt instrument or a syndicated bank loan)
- the periodic exchange of payments or the payment of a premium rather than the payment of fees that is customary with other off-balance-sheet credit products, such as letters of credit
- the use of an International Swaps and Derivatives Association (ISDA) Master Agreement and the legal format of a derivatives contract

Credit derivatives fall into three basic transaction types: total-rate-of-return swaps, credit-default swaps, and credit-default notes. Currently, total-rate-of-return swaps are the most commonly used credit derivatives.

Total-Rate-of-Return Swaps

In a total-rate-of-return (TROR) swap, one counterparty (Bank A) agrees to pay the total return on an underlying reference asset to its counterparty (Bank B) in exchange for LIBOR plus a

Figure 1—Total-Rate-of-Return Swap



spread. Most often, the reference asset is a corporate or sovereign bond or a traded commercial loan. Since many commercial loans are based on the prime rate, both “legs” of the swap float with market rates. In this manner, credit risk is essentially isolated and potential interest-rate risk is generally limited to some form of basis risk (for example, prime versus LIBOR).

TROR swaps are intended to be an efficient means of transferring or acquiring credit exposure without actually consummating a cash transaction. This feature may be desirable if a bank (Bank A) has credit exposure to a borrower and would like to reduce this exposure while retaining the banking relationship. Also, entities (such as Bank B) that are not able to bear the administrative costs of purchasing or administering loans or loan participations may still acquire exposure to these loans through TROR swaps.

In the example in figure 1, Bank A receives a LIBOR-based payment in exchange for paying out the return on an underlying asset. The total return payments due to Bank B include not only the contractual cash flows on the underlying assets but also any appreciation or depreciation of that underlying asset that occurs over the life of the swap. Periodically (usually quarterly), the asset’s market price is determined by an agreed-upon mechanism. Bank B would pay Bank A for any depreciation in the value of the underlying asset and would receive any appreciation. Consequently, for the term of the swap, Bank B “owns” the reference asset that resides on Bank A’s balance sheet.

At the maturity of the swap or in the event of default of the underlying asset, the swap is

terminated; the underlying asset is then priced for purposes of determining the final swap obligations.¹ The post-default price of the asset is most often determined by a poll of asset dealers or by direct market quotation, if available. Often, the final price will be the average of sample prices taken over time, which mitigates any post-default volatility in the reference asset's value.

If Bank B is not satisfied with the pricing of the asset upon the maturity of the swap or upon default (that is, Bank B believes the valuation is too low), then Bank B will often have the option of purchasing the underlying reference asset directly from Bank A and pursuing a workout with the borrower directly. However, it is not clear how often Bank B would choose to purchase the underlying instrument, particularly if the swap vehicle was used to avoid direct acquisition in the first place.

The final termination payment is usually based on the following formula:

$$\text{Final payment} = \text{Dealer price} - \text{Notional amount}$$

The notional amount is essentially the price of the reference asset when the credit derivative is initiated. If the dealer price is greater than the notional amount, then the asset has appreciated; Bank A must pay Bank B this difference to settle the swap. On the other hand, if the dealer price is below the notional amount, either depreciation (for example, downgrade or default) or principal reduction (for example, amortization or prepayment) has occurred, and Bank B owes Bank A this difference. Therefore, the final payment (either at maturity or upon default) ultimately defines the nature and extent of the transfer of credit risk.

Default events are described in the transaction documentation, usually in the trade confirmation. These events may include bankruptcy, payment defaults, breached covenants in loan or bond documentation, or even the granting of significant security interests by the reference obligor to one of its creditors. Often, a default event is defined so that it applies to any class of outstanding securities of the reference obligor that is in excess of a specified amount. In other words, a default can be triggered if the reference asset defaults or if any material class

of securities issued by the underlying obligor defaults.

In an alternative structure, two banks may exchange the total return on underlying groups of loans. For example, a large money-center bank may receive the total return on a concentrated loan portfolio of a regional bank in exchange for the total return on a more diversified group of loans held by the money-center bank. These types of swaps may be readily marketable to smaller banks that are seeking to comply with the concentration of credit limitations of section 305(b) of the Federal Deposit Insurance Corporation Improvement Act (FDICIA).

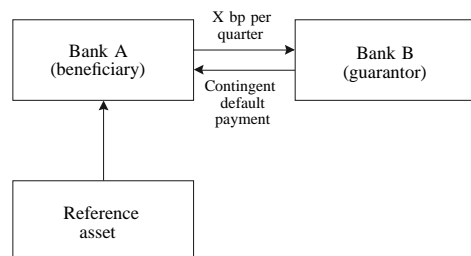
Credit-Default Swaps

Credit-default swaps made up over 50 percent of the credit derivatives market as of year-end 2001. In a credit-default swap, one counterparty (Bank A) agrees to make payments of X basis points of the notional amount, either per quarter or per year, in return for a payment in the event of the default of a prespecified reference asset (or reference name). (See figure 2.) Since the payoff of a credit-default swap is contingent on a default event (which may include bankruptcy, insolvency, delinquency, or a credit-rating downgrade), calling the structure a “swap” may be a misnomer; the transaction more closely resembles an option.

The following market conventions are common in the credit-default swap market:

- Reference entities generally are public, investment-grade companies; however, some trading has developed for high-yield credits.
- Trades are for senior, unsecured risk.

Figure 2—Credit-Default Swap



1. Alternatively, the swap may continue to maturity with payments that are based on quarterly changes in the post-default asset price.

- Five-year contracts are most common; however, one- and three-year contracts also trade.
- Prices are quoted in basis points per year.
- U.S. trades generally include only bankruptcy, failure to pay, and modified restructuring as credit events. Modified restructuring is defined under the May 11, 2001, ISDA Restructuring Supplement, which limited deliverables under a restructuring-only trigger and placed stricter conditions on when a restructuring is triggered.
- European trades generally include standard restructuring credit events.
- Trades become effective in three days (T+3).

Like TROR swaps, the occurrence of default in credit-default swaps is contractually well defined. Usually, the default event must be publicly verifiable. The default definition must be specific enough to exclude events whose inclusion would be undesirable, such as when a reference name is delinquent because the affiliated organization is withholding a payment in a legal dispute that does not affect the creditworthiness of the organization. Further, a materiality threshold may be involved; that is, a default event must have occurred, *and* the cumulative loss on the underlying must be greater than Y percent. The materiality thresholds increase the likelihood that only significant changes in credit quality will trigger the default payment (rather than the small fluctuations in value that tend to occur over time).

Finally, upon default, the “swap” is terminated and a default payment is calculated. The default payment is often calculated by sampling dealer quotes or observable market prices over some prespecified period after default has occurred. Alternatively, the default payment may be specified in advance as a set percentage of the notional amount (for example, 25, 50, or 100 percent). Such swaps are usually referred to as binary swaps; they either pay the prespecified amount or nothing, depending on whether default occurs. Binary swaps are often used when the reference asset is not liquid but loss in the event of default is otherwise subject to estimation. For example, if the reference asset is a senior, unsecured commercial bank loan and such loans have historically recovered 80 percent of face value in the event of default, a binary default swap with a 20 percent contingent payout may be appropriate.

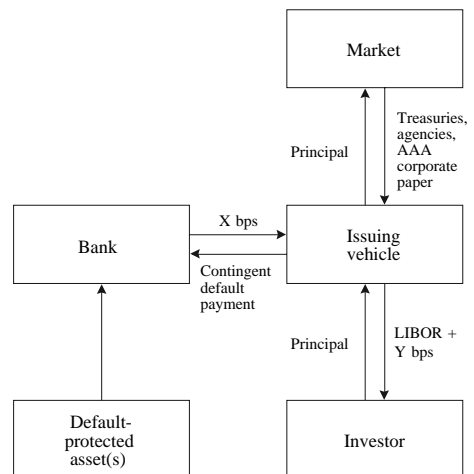
When the counterparty making the default payment (the guarantor) is unhappy with the valuation, the option to purchase the reference

asset is often available. On the other hand, some versions of default swaps may allow the beneficiary to put the asset to the guarantor in the event of default rather than receive a cash payment. When there is more than one underlying instrument (or name), which is often the case in a “basket” structure, the counterparty making the contingent default payment is exposed to only the first instrument or name to default. Credit-default swaps are generally governed by ISDA agreements and ISDA’s 2003 Credit Derivatives Definitions.

Credit-Default Notes

A credit-default note is a structural note and is the on-balance-sheet equivalent of a credit-default swap. In a credit-default note, an investor purchases a note from an issuing vehicle, often a trust. The trust uses the proceeds of the note purchase to purchase paper of the highest credit quality: Treasuries, agencies, or AAA corporate paper. The note is structured such that a default by the underlying reference instrument or name results in a reduction of the repayment of principal to the investor. (There may be more than one reference instrument or name.) Default payments are calculated in the same manner as they are for TROR and credit-default swaps. In return for the contingent default payment, the arranging bank pays a spread to the investor

Figure 3—Credit-Default Note



through the issuing vehicle. The investor, meanwhile, receives a premium yield over LIBOR for accepting the default risk of the underlying instrument or name. (See figure 3.)

USES

Both TROR and credit-default swaps are used to transfer the credit risk of the asset (or assets) referenced in the transaction. The counterparty seeking to transfer the credit risk (the beneficiary) often owns the reference asset. The counterparty receiving the credit risk of the reference asset (the guarantor) is able to do so without purchasing the reference asset directly.

Banks may use credit derivatives in several ways. They may elect to receive credit exposure (provide protection) for a fee. In an effort to better diversify their credit portfolios, banks may also receive credit exposure in exchange for credit exposure that they already hold. Banks may also elect to receive credit exposure through credit derivatives rather than through some other transaction structure because of the relative yield advantage (arbitrage of cash-market pricing) of derivatives.

Alternatively, banks may use credit derivatives to reduce either individual credit exposures or credit concentrations in their portfolios. In other words, the banks are purchasing credit protection from another institution. Banks may use credit derivatives to synthetically take a short position in an asset that they do not wish to sell outright. From the bank customer's perspective, credit derivatives may be written to allow nonbank counterparties to obtain access to bank loan exposures and their related returns, either as a new asset class (for credit diversification) or without up-front funding (perhaps to obtain greater leverage). In the last example, the bank is essentially performing traditional credit intermediation using a new off-balance-sheet vehicle.

Finally, banks may seek to establish themselves as dealers in credit derivatives. Rather than pursue credit portfolio efficiency or portfolio yield enhancement, dealer banks will seek to profit from buying and selling credit derivatives exposures quite apart from their portfolio-management goals. Dealer banks may or may not hold the assets referenced in their credit derivative transactions, depending on the banks' risk tolerance, credit views, and (ultimately) their ability to offset contracts in the marketplace.

MARKET PARTICIPANTS

Participants in the credit-default swap market fall into three main categories:

- *Bank hedgers.* Loan portfolio managers purchase default swap protection to offset loans in the banking book.
- *Capital-markets participants.* Insurers, reinsurers, and funds sell default swap protection.
- *Money-center banks and brokers.* Large dealer banks connect bank hedgers to the capital markets by intermediating trades in return for trading income.

PRICING

To understand credit derivative pricing and how different prices for reference assets might be obtained for different counterparties, consider the following example. A bank offers to provide default protection to another bank on a five-year loan to a BBB-rated borrower. Since reliable default and recovery data for pricing credit derivatives are not available, credit derivatives providers rely on credit spreads to price these products. One of the more common pricing techniques is to price an asset swap of the reference asset. In an asset swap, a fixed-for-floating interest-rate swap is used to convert a fixed-rate instrument (here, a BBB-rated note) into a floating-rate instrument. The spread above LIBOR required for this conversion to take place is related to the creditworthiness of the reference borrower. That is, the lower the creditworthiness of the reference borrower, the greater the spread above LIBOR will need to be to complete the asset swap. Hence, if LIBOR is viewed as a base rate at which the most credit-worthy institutions can fund themselves, then the spread above LIBOR represents the "credit premium," or the cost of default risk, associated with that particular reference asset.

The credit premium is the most fundamental component of pricing. The credit premium is meant to capture the default risk of the reference asset. Often, the credit premium is the periodic payment rate required by market participants in exchange for providing default protection. In a TROR swap, LIBOR plus this credit premium is paid in exchange for receiving the total return on the underlying reference asset. Intuitively, the owner of the reference asset, who receives

LIBOR plus the credit premium, is being compensated for the funding costs and default risk of the reference asset.

Furthermore, assume the reference asset is a BBB-rated, senior unsecured note of five-year maturity yielding 6.50 percent. Assume that the asking price for a five-year, fixed-for-floating interest-rate swap is 6.03 percent against LIBOR flat. To complete the asset swap, the interest-rate swap's legs need to be increased by 47 basis points each to convert the reference asset to a floating-rate instrument. (See figure 4.) Consequently, 47 basis points is the credit premium, or the implied market price to be charged, per year for providing default protection on this BBB-rated reference asset. Alternatively, LIBOR plus 47 basis points would be the price to be paid in a TROR swap for receiving the total return on this asset for five years.

However, the borrower-specific factors that produced the implied market price of 47 basis points for the default swap are not the only factors considered in pricing. The spread may be adjusted for any number of factors that are unique to the counterparties. For example, the spread may need to be adjusted for counterparty credit considerations. In the example in figure 2, if the credit quality of the guarantor counterparty (Bank B) was a concern to the beneficiary (Bank A), the beneficiary might negotiate payment of a lower spread (fee) than 47 basis points to compensate for counterparty risk.

Often, differences in funding costs between counterparties affect pricing. Operational considerations, such as the inability of a guarantor counterparty to actually own the asset, may result in a pricing premium for the risk seller (protection buyer) who can own the asset. Similarly, tax consequences may have an impact on transaction pricing. For example, to avoid trig-

gering an unfavorable taxable event, such as a taxable gain or a capital loss that is not fully deductible, a beneficiary may wish to reduce credit exposure to an obligor without actually selling the reference asset. Clearly, these considerations may have an impact on the price that the risk seller is willing to pay.

HEDGING

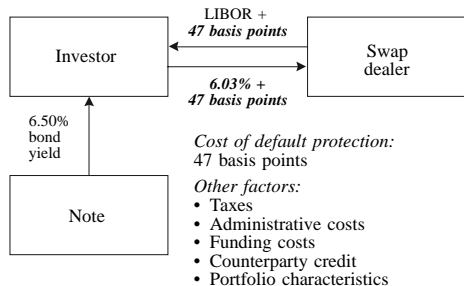
Credit derivatives may be hedged in two basic ways: users may match (or offset) their credit derivative contracts, or they may use a cash position in the reference asset to hedge their contracts.

The ideal hedging strategy for dealers is to match positions, or to conduct "back-to-back" trading. Many deals actually are conducted back to back with offsetting transactions as a result of the highly structured nature of these deals. That is, dealer banks won't enter into a credit derivative trade unless a counterparty that is willing to enter the offsetting transaction has been identified. Alternatively, the credit derivative trading function may conduct trades back-to-back with an internal counterparty (for example, the bank's own loan book). Because the secondary-market support for credit derivatives is characterized by substantial illiquidity, credit positions that are taken through credit derivatives may be "warehoused" for substantial periods of time before an offsetting trade can be found. Banks often set trading limits on the amount and time period over which they will warehouse reference-asset credit exposures in credit derivative transactions.

The second basic hedging practice is to own the underlying reference asset. Essentially, the risk-selling bank hedges by going long the reference asset and going short the swap. This is the simplest form of matched trading and is illustrated by Bank A in figures 1 and 2. Generally, whether or not the bank owned the reference asset before it entered the swap is a good indication of the purpose of the swap. If the bank owned the asset before executing the swap, it has most likely entered the swap for risk-management reasons. If the bank acquired the asset for purposes of transacting the swap, it is more likely to be accommodating a customer.

Interestingly, hedging a credit derivative in the cash market is not common when the cash

Figure 4—Asset Swap



position required is a short. Generally speaking, going short the reference asset and long the swap is problematic. Consider what happens in a declining market: The long credit derivative position (TROR receiver) declines in value, and the short cash position rises in value as the market falls. Unfortunately, most lenders of a security that is falling in value will not agree to continually lend and receive back a security that is undergoing a sustained depreciation in value. Since most short sales are very short term (in fact, overnight), the short cash hedge becomes unavailable when needed most—when there is a prolonged decline in the value of the reference asset. For this reason, a short credit derivative position may be superior to a short cash position that must be rolled over.

A third and less common practice is to simply add or subtract the notional amount of long or short positions, respectively, to or from established credit lines to reference obligors. This is the least sophisticated risk-management treatment and is inadequate for trading institutions because it does not address counterparty risks. This method may be used effectively *in conjunction with* other methods and is useful in determining total potential credit exposure to reference obligors.

At some point, the potential exists for credit derivatives dealers to apply a portfolio risk-management model that recognizes diversification and allows hedging of residual portfolio risks. However, the fundamental groundwork for quantitative modeling approaches to credit derivatives is still in development.

Finally, two other hedging issues are worth considering. First, it is not uncommon for banks to hedge a balance-sheet asset with a credit derivative that references a different asset of the same obligor. For example, a bank may hedge a highly illiquid loan to ABC Company with a credit-default swap that references the publicly traded debt of ABC Company. The fact that the public debt is more liquid and has public pricing sources available makes it a better reference asset than the loan. However, the bank is exposed to the difference in the recovery values of the loan and the debt if ABC Company defaults. Second, it is very common for the term of the credit derivative to be less than the term of the reference asset. For example, a two-year credit-default swap could be written on a five-year bond. In this case, the last three years of credit risk on the underlying bond position would not be hedged. The appropriate supervisory treat-

ment for credit derivatives is provided in SR-96-17. (See section 3020.1, “Securitization and Secondary-Market Credit Activities.”)

RISKS

Credit Risk

Banks that use credit derivatives are exposed to two sources of credit risk: counterparty credit risk and reference-asset credit risk. In general, the most significant risk faced by banks in credit derivatives will be their credit exposure to the reference asset.

When a bank acquires credit exposure through a credit derivative transaction, it will be exposed primarily to the credit risk of the reference asset. As they do with the credit risk that is acquired through the direct purchase of assets, banks should perform sufficient credit analyses of all reference assets that they will be exposed to through credit derivative transactions. The financial analysis performed should be similar to that performed for processing a loan or providing a letter of credit. Further, banks should have procedures in place to limit their overall exposure to certain borrowers, industries, or geographic regions, regardless of whether exposures are taken through cash instruments or credit derivative transactions.

Examiners should be aware that the degree of reference-asset credit risk transferred in credit derivative transactions varies significantly. For example, some credit derivatives are structured so that a payout only occurs when a predefined event of default or a downgrade below a pre-specified credit rating occurs. Other credit derivatives may require a payment only when a defined default event occurs *and* a predetermined materiality (or loss) threshold is exceeded. Default payments may be based on an average of dealer prices for the reference asset during some period of time after default by using a prespecified sampling procedure, or payments may be specified in advance as a set percentage of the notional amount of the reference asset. Lastly, the terms of many credit derivative transactions are shorter than the maturity of the underlying asset and, therefore, provide only temporary credit protection to the beneficiary. In these cases, some of the credit risk of the reference asset is likely to remain with the asset holder (protection buyer).

Alternatively, a bank may own an asset whose risk is passed on to a credit derivative counterparty. As such, the bank will only lose money if the asset deteriorates *and* the counterparty is unable to fulfill its obligations. Therefore, banks using credit derivatives to reduce credit exposure will be exposed primarily to counterparty risk. Because the ultimate probability of a loss for the bank is related to the default of both the reference credit *and* the inability of a counterparty to meet its contractual obligations, banks should seek counterparties whose financial condition and credit standing are not closely correlated with those of the reference credit.

In all credit derivative transactions, banks should assess the financial strength of their counterparty before entering into the transaction. Further, the financial strength of the counterparty should be monitored throughout the life of the contract. In some cases, banks may deem it appropriate to require collateral from certain counterparties or for specific types of credit derivative transactions.

Market Risk

While banks face significant credit exposure through credit derivative transactions, significant market risk is also present. The prices of credit derivative transactions will fluctuate with changes in the level of interest rates, the shape of the yield curve, and credit spreads. Furthermore, because of the illiquidity in the market, credit derivatives may not trade at the theoretical prices suggested by asset-swap pricing methodologies. Therefore, price risk is a function of market rates as well as prevailing supply and demand conditions in the credit derivative market.

The relative newness of the market for credit derivatives and the focus of some products on events of default makes it difficult for banks to hedge these contingent exposures. For example, banks that sell default swaps will probably make payments quite infrequently because events of default are rare. Hence, the payoff profile for a default swap includes a large probability that default will not occur and a small probability that a default will occur with unknown consequences. This small probability of a default event is difficult for banks to hedge, especially as the reference asset deteriorates in financial condition.

Liquidity Risk

Typically, liquidity risk is measured by the size of the bid/ask spread. Similar to other new products, credit derivatives may have higher bid/ask spreads because transaction liquidity is somewhat limited. Banks that are buying credit derivatives should know that their shallow market depth could make it hard to offset positions before a credit derivative's contract expires. Accordingly, banks that are selling credit derivatives must evaluate the liquidity risks of credit derivatives and assess whether some form of reserves, such as close-out reserves, is needed.

Banks that use credit derivatives should include the cash-flow impact of credit derivatives into their regular liquidity planning and monitoring systems. Banks should also include all significant sources and uses of cash and collateral related to their credit derivative activity into their cash-flow projections. Lastly, the contingency funding plans of banks should assess the effect of any early-termination agreements or collateral or margin arrangements, along with any particular issues related to specific credit derivative transactions.

Legal Risk

Because credit derivatives are new products that have not yet been tested from a legal point of view, many questions remain unanswered. At a minimum, banks should ensure that they and their counterparties have the legal and regulatory authority to participate in credit derivative transactions before committing to any contractual obligations. Moreover, banks should ensure that any transactions they enter into are in agreement with all relevant laws governing their activities.

ISDA published 2003 Credit Derivatives Definitions that reflect the growth in the credit derivatives market. The 2003 Definitions amend, among other things, various credit events and provide alternatives for restructuring. Banks should have their legal counsel review all credit derivative contracts to confirm that they are legally sound and that all terms, conditions, and contingencies are clearly addressed.

EXAMINER GUIDANCE

When reviewing credit derivatives, examiners should consider the credit risk of the reference asset as the primary risk. A bank that provides credit protection through a credit derivative can become as exposed to the credit risk of the reference asset as it would if the asset were on its own balance sheet. Thus, for supervisory purposes, the exposure typically should be treated as if it were a letter of credit or other off-balance-sheet guarantee. For example, this type of treatment would apply for determining an institution's overall credit exposure to a borrower when evaluating its concentrations of credit.

In addition, examiners should perform the following procedures.

- Review SR-96-17.
- Note the bank's credit derivative activities and ascertain (1) the level of credit derivative activity, (2) the types of counterparties, (3) the typical underlying reference assets, (4) the structures and maturities of the transactions, (5) why management is using these instruments, and (6) whether the bank's credit exposure is being increased or reduced.
- Evaluate whether the bank subjects its credit derivatives activities to a thorough, multi-functional new-product review and determine if senior management is aware of and approves the activities undertaken.
- Ensure that credit derivatives are reported correctly for regulatory purposes. Examiners should determine that any transfer risk received or passed on in a credit derivative structure is captured in the bank's regulatory transfer-risk reports.
- Ensure that the bank maintains documentation for its accounting policies for credit derivatives. Determine whether the bank has consulted with outside accountants when developing these policies and procedures. Assess the bank's mark-to-market, profit recognition, and hedge accounting practices.
- Review management's strategy for using credit derivatives, assess the impact of these derivatives on the bank's risk profile, and ensure that adequate internal controls have been established for the conduct of all trading and end-user activities in credit derivatives.
- Review risk-management practices to ensure that bank systems capture all credit exposures

and that trading desks report these exposures, including counterparty and reference-asset exposures from credit derivatives, to senior management.

- Ensure that risk-management reports are completed on a timely basis and are disseminated to the appropriate personnel.
- Assess the bank's treatment of credit derivatives for purposes of legal lending limits. (That is, when should the bank use credit derivatives to lower borrower concentrations and which type of credit derivative should the bank use?) Ensure that the bank is in compliance with all regulatory lending limits.
- Review the bank's asset-quality and loan-loss reserve policies for credit derivatives and any reference assets owned. Ensure that assets protected by credit derivatives that are non-performing are recognized in internal credit reports. Assess how the bank's loan-loss reserves are affected by the use of credit derivatives. Ensure that the bank's classification system is reasonable given the types of credit derivatives structures used, the degree to which credit risk is transferred, and the creditworthiness of its credit derivative counterparties.
- Procure and review relevant marketing materials and policies on sales practices. Dealers should assess the financial character and sophistication of all counterparties. Since credit derivatives are new and complex instruments, dealers should provide end-users with sufficient information to enable them to understand the risks associated with particular credit derivative structures.

ACCOUNTING TREATMENT

The accounting treatment for certain credit derivatives is determined by the Financial Accounting Standards Board's Statement of Financial Accounting Standards No. 133 (FAS 133), "Accounting for Derivatives and Hedging Activities," as amended by Statement of Financial Accounting Standards Nos. 137 and 138 (FAS 137 and FAS 138). (See section 2120.1, "Accounting," for further discussion.)

RISK-BASED CAPITAL WEIGHTING

The appropriate risk-based capital treatment for

credit derivative transactions is discussed in SR-96-17. The appropriate treatment for credit derivatives under the market-risk capital amendment to the Basel Accord is not finalized as of this writing. As a general rule, SR-96-17 provides the appropriate capital treatment for credit derivatives that are carried in the banking book and for institutions that are not subject to the market-risk rules.

Under SR-96-17, credit derivatives generally are to be treated as off-balance-sheet direct-credit substitutes. The notional amount of the contract should be converted at 100 percent to determine the credit equivalent amount to be included in risk-weighted assets of the guarantor.² A banking organization providing a guarantee through a credit derivative transaction should assign its credit exposure to the risk category appropriate to the obligor of the reference asset or any collateral. On the other hand, a banking organization that owns the reference asset upon which credit protection has been acquired through a credit derivative may, under certain circumstances, assign the unamortized portion of the reference asset to the risk category appropriate to the guarantor, for example, the 20 percent risk category if the guarantor is a bank or the 100 percent risk category if the guarantor is a bank holding company.

Whether the credit derivative is considered an eligible guarantee for purposes of risk-based capital depends on the degree of credit protection actually provided. As explained earlier, the amount of credit protection actually provided by a credit derivative may be limited depending on the terms of the arrangement. For example, a relatively restrictive definition of a default event or a materiality threshold that requires a comparably high percentage of loss to occur before the guarantor is obliged to pay could effectively limit the amount of credit risk actually transferred in the transaction. If the terms of the credit derivative arrangement significantly limit the degree of risk transference, then the beneficiary bank cannot reduce the risk weight of the “protected” asset to that of the guarantor bank. On the other hand, even if the transfer of credit risk is limited, a banking organization providing

limited credit protection through a credit derivative should hold appropriate capital against the reference exposure while the organization is exposed to the credit risk of the reference asset. See section 3020.1, “Securitization and Secondary-Market Credit Activities.”

Banking organizations providing a guarantee through a credit derivative may mitigate the credit risk associated with the transaction by entering into an offsetting credit derivative with another counterparty, a so-called back-to-back position. Organizations that have entered into such a position may treat the first credit derivative as guaranteed by the offsetting transaction for risk-based capital purposes. Accordingly, the notional amount of the first credit derivative may be assigned to the risk category appropriate to the counterparty providing credit protection through the offsetting credit derivative arrangement (for example, to the 20 percent risk category if the counterparty is an OECD bank).

In some instances, the reference asset in the credit derivative transaction may not be identical to the underlying asset for which the beneficiary has acquired credit protection. For example, a credit derivative used to offset the credit exposure of a loan to a corporate customer may use a publicly traded corporate bond of the customer as the reference asset; the credit quality of the bond serves as a proxy for the on-balance-sheet loan. In such a case, the underlying asset will still generally be considered guaranteed for capital purposes as long as both the underlying asset and the reference asset are obligations of the same legal entity and have the same level of seniority in bankruptcy. In addition, banking organizations offsetting credit exposure in this manner would be obligated to demonstrate to examiners that (1) there is a high degree of correlation between the two instruments; (2) the reference instrument is a reasonable and sufficiently liquid proxy for the underlying asset so that the instruments can be reasonably expected to behave similarly in the event of default; and (3) at a minimum, the reference asset and underlying asset are subject to mutual cross-default provisions. A banking organization that uses a credit derivative, which is based on a reference asset that differs from the protected underlying asset, must document the credit derivative being used to offset credit risk and must link it directly to the asset or assets whose credit risk the transaction is designed to offset. The documentation and the effectiveness of the credit derivative transaction are subject to

2. Guarantor banks that have made cash payments representing depreciation on reference assets may deduct such payments from the notional amount when computing credit-equivalent amounts for capital purposes. For example, if a guarantor bank makes a depreciation payment of \$10 on a \$100 notional total-rate-of-return swap, the credit-equivalent amount would be \$90.

examiner review. Banking organizations that provide credit protection through such arrangements must hold capital against the risk exposures that are assumed.

LEGAL LIMITATIONS FOR BANK INVESTMENT

While examiners have not seen credit derivative transactions involving two or more legal entities within the same banking organization, the possibility of such transactions exists. Transactions between or involving affiliates raise important supervisory issues, especially whether such arrangements are effective guarantees of affiliate obligations or are transfers of assets and their

related credit exposure between affiliates. Therefore, banking organizations should consider carefully the existing supervisory guidance on interaffiliate transactions before entering into credit derivative arrangements involving affiliates, especially when substantially the same objectives could be achieved using traditional guarantee instruments.

Legal lending limits are established by individual states for state-chartered banks and by the Office of the Comptroller of the Currency (OCC) for national banks. Therefore, the determination of whether credit derivatives are guarantees to be included in the legal lending limits are the purview of the state banking regulators and the OCC.

GENERAL DESCRIPTION

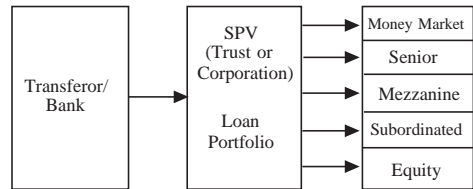
Collateralized loan obligations (CLOs) are securitizations of large portfolios of secured or unsecured corporate loans made to commercial and industrial customers of one or more lending banks. CLOs offer banking institutions a means of achieving a broad range of financial objectives, including, but not limited to, the reduction of credit risk and regulatory capital requirements, access to an efficient funding source for lending or other activities, increased liquidity, and increased returns on assets and equity. Furthermore, institutions are able to realize these benefits without disrupting customer relationships. CLO structures generally fall into two categories: cash-flow structures and market-value structures. Cash-flow structures are transactions in which the repayment and ratings of the CLO debt securities depend on the cash flow from the underlying loans. Market-value structures are distinct from cash-flow structures in that credit enhancement is achieved through specific overcollateralization levels assigned to each underlying asset. Most bank CLOs have been structured as cash-flow transactions.

To date, most bank-sponsored CLOs have been very large transactions—typically ranging from \$1 billion to \$6 billion—undertaken by large, internationally active banking institutions. However, as the CLO market evolves and the relative costs decline, progressively smaller transactions may become feasible, and the universe of banks that can profitably use the CLO structure will increase significantly.

CHARACTERISTICS AND FEATURES

In a CLO transaction, loans are sold, participated, or assigned into a trust or other bankruptcy-remote special-purpose vehicle (SPV), which, in turn, issues asset-backed securities consisting of one or more classes, or tranches. Alternatively, a CLO may be synthetically created through the use of credit derivatives, for example, default swaps or credit-linked notes, that are used to transfer the credit risk of the loans into the trust or SPV and, ultimately, into the capital markets.

Figure 1—Collateralized Loan Obligation



Typically, the asset-backed securities issued by the trust or SPV consist of one or more classes of rated debt securities, one or more unrated classes of debt securities that are generally treated as equity interests, and a residual equity interest. These tranches generally have different rates of interest and projected weighted average lives to appeal to different types of investors. They may also have different credit ratings. It is common for the bank to retain a subordinated or equity interest in the securitized assets to provide the senior noteholders with additional credit enhancement. This provision of credit support by the sponsoring bank triggers regulatory “low-level recourse” capital treatment.

Conceptually, the underlying assets collateralizing the CLO’s debt securities consist of whole commercial loans. In reality, the underlying assets frequently consist of a more diverse mix of assets which may include participation interests, structured notes, revolving credit facilities, trust certificates, letters of credit, and guarantee facilities, as well as synthetic forms of credit.

One or more forms of credit enhancement are almost always necessary in a CLO structure to obtain the desired credit ratings for the most highly rated debt securities issued by the CLO. The types of credit enhancements used by CLOs are essentially the same as those used in other asset-backed securities structures—“internal” credit enhancement provided by the underlying assets themselves (such as subordination, excess spread, and cash collateral accounts) and “external” credit enhancement provided by third parties (principally financial guaranty insurance issued by monoline insurers). In the past, most bank CLOs have relied on internal credit enhancement.

Bank CLOs can be further divided into linked and de-linked structures. In a linked structure, the sponsoring bank provides some degree of implicit or explicit credit support to the transaction as a means of improving the credit rating of some or all of the tranches. While such credit linkage may improve the pricing of a transaction, the bank's provision of credit support may constitute recourse for risk-based capital purposes, thus increasing the capital cost of the transaction. In contrast, the CLO issuer in a de-linked structure relies entirely on the underlying loan assets and any third-party credit enhancement for the credit ratings of the debt securities.

CLO transactions are evolving into highly customized and complex structures. Some transactions that may appear similar on the surface differ greatly in the degree to which credit risk has been transferred from the bank to the investor. In some cases, the actual transference of credit risk may be so limited that the securitization meets the regulatory definition of "asset sales with recourse," thus requiring the bank to hold capital against the securitized assets.

TYPES

CLOs Using the Master Trust Structure

CLOs are complex transactions that typically use a master trust structure. Historically, the master trust has been used for revolving, short-term assets such as credit card receivables. This format affords the issuer a great deal of flexibility in structuring notes with different repayment terms and characteristics, and provides for the ongoing ability to transfer assets and offer multiple series, which allows for greater diversification and minimized transaction costs. Consequently, securitizations through a master trust structure are often assigned series numbers, such as 1998-1, 1998-2, etc., to identify each specific securitization. These transactions may have many interrelated components that make them particularly difficult to analyze.

CLO master trust applications need to be carefully designed. In contrast to typical master trust assets such as credit card receivables, corporate loan portfolios are less diversified, cash flows are not as smooth, and lower yields

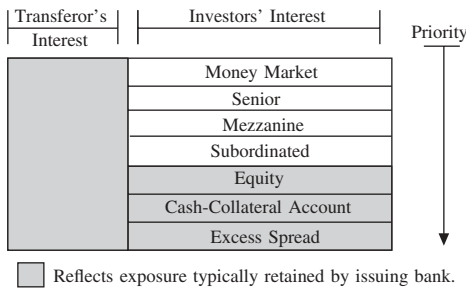
generate less excess spread. The CLO master trust also needs to be structured to mitigate the resulting mismatches between the maturities of heterogeneous collateral assets and liabilities, and to pay all series by their stated maturities.

The master trust structure can be contrasted with other types of trusts, such as the grantor's and owner's trusts, that restrict the types of asset-backed securities that can be issued or have other limitations. The simplest trust form requires the straight pass-through of the cash flows from trust assets to investors without any restructuring of those cash flows.

A distinguishing feature of CLOs using the master trust structure is the transferor's (seller's) interest, which represents the selling bank's required retained interest in the assets transferred to the master trust. One purpose of the transferor's interest in credit card securitizations is to ensure that the principal balance of assets in the trust is more than sufficient to match the principal balance of notes that have been issued to investors. In addition, the transferor's interest is essentially a "shock absorber" for fluctuations in principal balances due to additional draws under credit facilities and principal paydowns, whether scheduled or not. In definitional terms, the transferor's interest is equal to the total trust assets less the investors' interest, or that portion of the pool allocated to backing the notes issued to investors. The issuing bank is usually required to maintain its transferor's interest at a predetermined percentage of the overall trust size, usually 3 to 6 percent in a CLO transaction. As such, the transferor's interest within the master trust framework is on an equal footing with the investors' interest.

However, the use of a master trust structure and the creation of a transferor's interest in a CLO transaction may create some unique problems. The very existence of the two interests (transferor's and investors'), the nonhomogeneity of the loans being securitized, and the comparatively concentrated nature of commercial loan portfolios suggest that the distribution of those loans between the two interests must be reviewed and monitored carefully. It is critical to understand the basis for the distribution of credits between the two interests and the conditions under which this distribution may change over the life of the securitization in order to determine whether the transaction contains embedded recourse to the bank.

Figure 2—CLO Master-Trust Structure



Common Features of CLO Master-Trust Structures

In order for issuers of CLOs to attract institutional investors, for example, insurance companies and pension funds, the securities being issued are often rated. Rating agencies consider the credit quality and performance history of the securitized loan portfolio in determining the credit rating to be assigned, as well as the structure of the transaction and any credit enhancements supporting the transaction.

In CLO transactions, the three most common forms of credit enhancement are (1) subordination, (2) the funding of a cash-collateral account, and (3) the availability of any excess spread on the transaction to fund investor losses. Subordination refers to securitization transactions that issue securities of different seniority, that is, senior noteholders are paid before subordinated noteholders. It is common for the issuing bank to retain the most junior tranche of the investor notes. This interest is included in the investors' interest. It is distinct from the transferor's interest and is held on the transferor's balance sheet as an asset. Thus, third-party investors gain assurance that the bank will maintain the credit quality of the loans when the bank retains the first-loss exposure in the investor interest.

In addition to retaining the most junior tranche of investor notes, the bank may fund a cash-collateral account. The cash-collateral account functions as another layer of credit protection for the investors' interest. If there is a shortfall in loan collections in any period that prevents asset-backed noteholders from being paid, the cash collateral account may be drawn down.

Finally, the yield of the loans placed in the trust often exceeds the total coupon interest

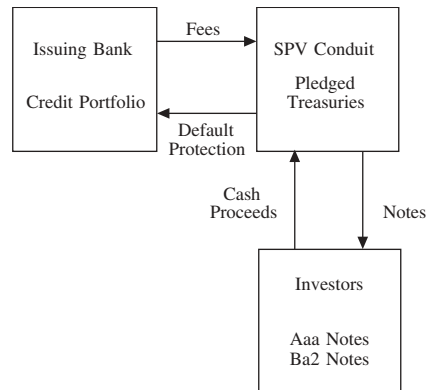
payments due investors on the asset-backed notes issued. The residual yield is called excess spread and is usually available to fund investor losses.¹

Synthetic CLO Securitizations

Recent innovations in securitization design have resulted in a class of synthetic securitization that involves different risk characteristics than the standard CLOs described above. One type of synthetic securitization uses credit derivatives to transfer a loss potential in a designated portfolio of credit exposures to the capital markets. The intent of the transaction is to transfer credit risk on a specific reference portfolio of assets to the capital markets and to achieve a capital charge on the reference portfolio that is significantly lower than 8 percent.

In the example in figure 3, the banking organization identifies a specific portfolio of credit exposures, which may include loan commitments, and then purchases default protection from a special-purpose vehicle. In this case, the

Figure 3—Synthetic CLO Securitization



1. Note that any loss position that a bank retains in its own securitization is subject to low-level-recourse capital treatment. A loss position would include retention of the most junior investor notes, the cash-collateral account, and excess spread, if recorded as an asset on the bank's balance sheet. (See Statement of Financial Accounting Standards No. 140 (FAS 140), "Accounting for Transfers and Servicing of Financial Assets and Extinguishments of Liabilities," for more information on the sale of assets and the recording of resulting assets and liabilities on the balance sheet.)

credit risk on the identified reference portfolio is transferred to the SPV through the use of credit-default swaps. In exchange for the credit protection, the institution pays the SPV an annual fee.

To support its guarantee, the SPV sells credit-linked notes (CLNs) to investors and uses the cash consideration to purchase Treasury notes that are then pledged to the banking organization to cover any default losses.² CLNs are obligations whose principal repayment is conditioned upon the default or nondefault of a referenced asset. The CLNs may consist of more than one tranche, for example, Aaa-rated senior notes and Ba2-rated subordinated notes, and are issued in an amount that is sufficient to cover some multiple of expected losses—typically, about 7 percent of the notional amount of the reference portfolio.

There may be several levels of loss in a synthetic securitization. The first-loss position may be a small cash reserve that accumulates over a period of years and is funded from the excess of the SPV's income (that is, the yield on the Treasury securities plus the fee for the credit-default swap) over the interest paid to investors on the notes. The investors in the SPV assume a second-loss position through their investment in the SPV's notes. Finally, the banking organization retains the risks associated with any credit losses in the reference portfolio that exceed the first- and second-loss positions.

In figure 3, default swaps on each of the obligors in the reference portfolio are executed and structured to pay the average default losses on all senior, unsecured obligations of defaulted borrowers. Typically, no payments are made until maturity, regardless of when a reference obligor defaults. A variation of this structure uses CLNs to transfer the credit risk from the transferring bank to the SPV instead of using credit-default swaps as in the above structure. In turn, the SPV issues a series of floating-rate notes ("notes") in several tranches to investors. The notes are then collateralized by a pool of CLNs, with each CLN representing one obligor and its credit-risk exposure (such as bonds, loans, or counterparty exposure). Thus, the dollar amount of notes issued to investors equals the notional amount of the reference portfolio.

The institution has the option to call any of the CLNs before maturity so long as they are replaced by CLNs that meet individual obligor and portfolio limits. These limits include concentration limits, maturity limits, and credit-quality standards that must be met to maintain the credit ratings of the notes. If the CLNs no longer meet collateral guidelines, there are early-amortization provisions that will cause the transaction to wind down early.

If any obligor linked to a CLN in the SPV defaults, the institution will call the note and redeem it based either on the post-default market value of the reference security of the defaulted obligor or on a fixed percentage of par that reflects the average historical recovery rate for senior unsecured debt. The fixed percentage method is used when the linked obligor has no publicly traded debt. Finally, the term of each CLN is set such that the credit exposure to which it is linked matures before the CLN, ensuring that the CLN will be in place for the full term of the exposure to which it is linked.

Synthetic CLO structures differ from many traditional CLO structures in two significant ways:

1. In most CLO structures, assets are actually transferred into the SPV. In the synthetic securitizations, the underlying exposures that make up the reference portfolio remain on the institution's balance sheet. The credit risk is transferred into the SPV through credit-default swaps or CLNs. In this way, the institution is able to avoid sensitive client relationship issues arising from loan-transfer notification requirements, loan-assignment provisions, and loan-participation restrictions. Client confidentiality may also be maintained. The CLN-backed synthetic CLO also simplifies the legal work involved by avoiding the transfer of collateral and the creation or perfection of a security interest in anything other than the CLN.
2. In many CLO structures, the opportunity to remove credit risk from—or add credit risk to—the underlying collateral pool is severely limited. In the CLN-backed CLO, the institution may actively manage the pool of CLNs, thereby managing the credit risk of the linked exposures on an ongoing basis. In this way, the structure can be used to free up credit lines for core clients with whom the institution would like to conduct more business.

2. The names of corporate obligors included in the reference portfolio may be disclosed to investors in the CLNs.

RISK-TRANSFERENCE ISSUES

Reallocation of Cash Flows

One of the provisions commonly associated with complex CLOs is the provision for the reallocation of cash flows under certain circumstances. Cash-flow reallocation may take a number of forms, but is usually provided to ensure that senior noteholders get paid before junior noteholders. For example, if loan collections are insufficient to fund the payments of the senior notes of a CLO and other credit enhancements have been exhausted, or the securitization has entered an amortization phase, the servicer may be required to redirect payments from junior noteholders to senior noteholders. In some structures, principal payments on loans that are originally allocated to paying down the principal balance of the junior notes may be reallocated to the payment of current (or delinquent) interest on senior notes. This recharacterization of principal to interest may be a source of recourse if investor note balances are not reduced for the principal payment, due to the fact that a loan underlying the investor interest has paid off and is no longer available to support outstanding investor principal balances. Therefore, the bank will be required to provide new loans to back the investors' interest, either from the transferor's interest or from its own balance sheet.

Another distinguishing feature of CLOs that use the master trust structure is the revolving period. During the revolving period of a CLO, the investor notes are only paid interest, that is, the notes have not yet entered the amortization phase.³ However, some of the underlying loan balances are actually being repaid during this time. During the revolving period, such repayments are automatically reinvested in new loans to maintain the principal balance of loans backing the investor notes. In some securitizations, this allocation of cash flows may be interrupted. Specifically, under certain conditions, such as a deteriorating collection rate, a collateral deficiency, or noncompliance with rating-agency

guidelines, principal repayments on loans may be withheld from the transferor during the revolving period. Thereafter, if the deficiencies remain uncorrected, the funds thus withheld may be available to pay down investor notes. Examiners need to carefully review the conditions under which cash flows are reallocated and circumstances under which normal flows are interrupted to determine the overall impact on the credit-risk transference achieved in CLOs.

Early Amortization

A standard feature of CLO securitizations is a provision for early amortization. Early amortization provisions are designed to protect noteholders in the event the loans in the trust experience significant difficulty, diminishing the prospects for repayment of investor notes. When an early amortization event occurs (for example, defaults in the loan pool reach a certain predetermined level), collections on the underlying loans are reallocated so that investors are paid off at an accelerated rate. Typically, cash flows are allocated based on the proportional share of the trust that the transferor and investor interests represent when the early amortization event occurs. The allocation percentage thereafter remains fixed. This mechanism works to favor the investor interest, as additional drawdowns on facilities in the trust cause the transferor interest to increase (that is, additional lending under existing lines participated into the trust is assigned to the transferor's interest). Therefore, the size of the transferor interest grows rapidly relative to the size of the investor interest, but cash flow from the entire pool of trust assets continues to be allocated based on the fixed percentage that was determined when the early amortization event occurred. For example, assume the current allocation based on the relative size of investors' and transferor's interest is 80 percent and 20 percent, respectively. If early amortization were triggered, this percentage would be used to allocate all future principal collections, regardless of the actual relative size of the transferor and investor interests at any future date. While the existence of early amortization provisions has not been treated as recourse for regulatory purposes, early amortization is viewed in the marketplace as a form of credit enhancement. Credit-rating agencies indi-

3. Investor notes may either mature at a point in time or may amortize over a specific period, usually one year. In either case, principal payments on the underlying loans may begin to accumulate a few months before maturity or the commencement of an amortization period in order to provide additional assurance that contractual principal payments can be made.

cate that such provisions can reduce the amount of credit enhancements or recourse needed to secure a given rating by more than half.

While early amortization provisions alone have not been deemed recourse to the bank, they have been recognized as creating conditions that might result in the transferring bank's retaining a degree of credit risk.⁴ When a securitization triggers an early amortization event, the bank has two choices. It can allow the early amortization to proceed, causing the securitization to unwind. If a bank were to allow an early amortization to occur, its access to the asset-backed market in the future could become impaired and more expensive. Alternatively, the bank may choose to voluntarily correct the deficiency leading to the early amortization condition. Banks may be willing to support their securitizations, notwithstanding any legal obligation to do so, to preserve their name in the marketplace. However, such actions may have regulatory capital implications.

Other Issues

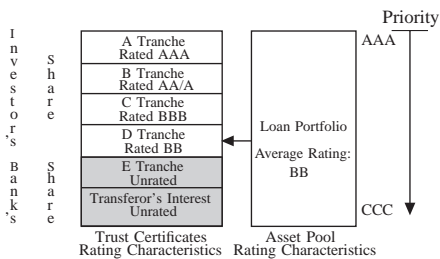
In some CLO transactions, it may be unclear whether a significant portion of underlying credit risk has been passed along to investors in the asset-backed securities. Assume that a \$4 billion CLO has been completed in which the average underlying loan is rated BB. Further, assume that interests in these loans were segregated into a traditional CLO structure (see figure 4). In this case, the underlying loan pool has been trans-

formed into interests in the securitization vehicle (trust or other SPV), and all of the securities issued to investors are rated equal to—or higher than—the average rating of the loans in the pool. The only other interests in the pool are retained by the issuing bank, that is, the subordinated piece of the investor interest and the transferor's interest. These interests are typically unrated. However, since the investor securities are all rated above the average loan rating of the loan pool, one could reasonably presume that the implicit credit rating of the bank's retained interests are lower than average. Further, since the dollar volume of the bank's retained interest is usually much smaller than the investors' interest, one might reasonably conclude that the implicit credit rating of these interests is much lower than the investor interest. In such cases, it is not clear whether the investors have assumed a meaningful portion of the credit risk of the underlying loans. Hence, the issue is not recourse in the traditional sense, but whether significant transference of risk has occurred in the first place.

In some situations, certain trust covenants may function as credit support, leading to recourse to the securitizing bank. For example, the trust may require the bank to maintain the average credit rating of the loans in the trust. This may be accomplished by a requirement to remove deteriorating loans from the trust and replace them with higher-quality loans. Alternatively, the deteriorating loans may be "reallocated" to the transferor's interest, with the bank providing new loans of higher quality to the trust to back the investors' interest. In either case, the potential for recourse to the issuing bank is significant.⁵

To obtain a favorable credit rating, covenants may place limitations on the amount of credit extended to a particular industry as well as on the maximum exposure to any particular obligor. For example, rating agencies may require that total credit exposure to any particular industry not exceed 5 percent of the trust in order for the notes issued to achieve a particular rating. Any exposures over the limit may be assigned to

Figure 4—Distribution of Risks



4. See SR-97-21, "Risk Management and Capital Adequacy of Exposures Arising from Secondary Market Credit Activities," July 11, 1997.

5. One factor in determining whether transactions include recourse is the sharing of loss that occurs when deteriorating assets are sold from the trust. If the loss is shared proportionately between investor and transferor interests, it is less likely that the transaction will be deemed to have recourse to the bank.

the transferor's interest as an "overconcentration" amount. Because revolving credit facilities vary in size over time and their balances tend to be large, industry overconcentration appears to be common in these structures. The end result is that the investors' interest remains well diversified at all times, while the transferor's interest absorbs all overconcentration amounts. In this case, the risk of the transferor's interest and the investors' interest is not the same. However, such industry concentration limits by themselves generally will not result in a determination that the bank is providing recourse to the trust.

Similarly, trust documents may limit the exposure of any particular obligor in the trust. Obligor concentration limits may become problematic when the limit assigned is a function of the credit rating of the obligor. When a credit in the trust is downgraded below a defined threshold level, the "excess" exposure to the obligor may either be removed from the trust by the issuing bank or may be assigned to an overconcentration amount within the transferor's interest. In this case, it is not only possible that the transferor is absorbing credit exposures that exceed industry concentration limits (as described above), but it may also absorb exposures to credits that are deteriorating. If these requirements function in a manner that tends to reallocate deteriorating credits to the transferor's interest before default, the transaction may meet the regulatory definition of asset sales with recourse.

In addition to the common structural features described above, there may be other conditions under which loan balances may be reallocated between transferor and investor interests. Further, unique contractual requirements may specify how losses will be shared between the two interests in the event of default (or some other defined credit event). Through these contractual provisions, the bank may continue to have significant or contingent exposure to the securitized assets.

In summary, while examiners may be able to highlight recourse issues, it is not always clear where the lines should be drawn, as the mechanisms involved in these transactions are not always transparent. The issue is further complicated by the fact that banking organizations outside the United States are engaging in these transactions, and the treatment applied by foreign bank supervisory authorities may not parallel U.S. supervisory treatment.

USES

Banks have used CLOs to achieve a number of different financial objectives, including the important goal of maximizing the efficient use of their economic capital in the context of the current regulatory capital rules. Considering the small margins on commercial loans relative to other banking assets, the high risk-based capital requirement of these loans, especially those of investment-grade quality, makes holding them a less profitable or efficient use of capital for some banks. Using a CLO to securitize and sell a portfolio of commercial loans can free up a significant amount of capital that can be used more profitably for other purposes, such as holding higher-yielding assets, holding lower risk-weighted assets, making acquisitions, paying dividends, and repurchasing stock. As a result, this redeployment of capital can have the effect of reducing capital requirements, and/or improving return on equity and return on assets.

Issuers also obtain other advantages by using CLOs and synthetic securitizations, including accessing more favorable capital-market funding rates and, in some cases, transferring credit risk; increasing institutional liquidity; monetizing gains in loan value; generating fee income by providing services to the SPV; and eliminating a potential source of interest-rate risk. In addition, CLOs can be used for balance-sheet management and credit-risk hedging, that is, securitizations enable the sponsor to transfer assets with certain credit-quality, spread, and liquidity characteristics from the balance sheet while preserving relationships with borrowers. In this manner, the bank can reduce its exposure to risk concentrations.

From the viewpoint of investors, CLO spreads are attractive compared with those of other, more commoditized asset classes and can offer portfolio-diversification benefits. The various tranches represent a significant arbitrage opportunity to yield-seeking investors, and investment-grade CLOs can provide a spread premium to investors who are limited by regulatory or investment restrictions from directly purchasing individual non-investment-grade securities. In addition, the performance history of CLOs has so far been favorable—an important factor in attracting investors, especially in the lower, supporting mezzanine or equity tranches in a CLO capital structure. These subordinated investors demand a premium return that is commensurate with the higher risk they bear.

DESCRIPTION OF MARKETPLACE

The primary buyers for CLO securities have been insurance companies and pension funds seeking attractive returns with high credit quality. To date, banking organizations typically have not been active buyers of these securities. The secondary market is less fully developed and less active than the market for more traditional types of asset-backed securities. However, as the market grows and expands globally to spread-seeking investors, CLO securities are becoming more liquid.

Market transparency can be less than perfect, especially when banks and other issuers retain most of the economic risk despite the securitization transaction. In addition, the early amortization features of some CLO transactions may not be fully understood by potential buyers.

PRICING

Securities issued in CLOs and synthetic securitizations carry coupons that can be fixed (generally yielding between 50 and 300 basis points over the Treasury curve) or floating (for example, 15 basis points over one-month LIBOR). Pricing is typically designed to reflect the coupon characteristics of the loans being securitized. The spread will vary depending on the credit quality of the underlying collateral, degree and nature of the credit enhancement, and degree of variability in the cash flows emanating from the securitized loans.

HEDGING

CLO issuers often use a variety of hedging instruments, including interest-rate swaps, currency swaps, and other derivatives, to hedge against various types of risk. For example, if the underlying assets are not denominated in U.S. dollars, currency risk may be hedged with swaps, caps, or other hedging mechanisms. Convertibility risk is considered for certain currencies in which the sovereign may be likely to impose currency restrictions. In such cases, certain currencies may not be permitted in the collateral pool regardless of the hedging mechanisms in place. Hedging instruments may also be used to

address cash-flow mismatches between the payment characteristics of the CLO debt obligations and the underlying loans, such as differences in frequency of payments, payment dates, interest-rate indexes (basis risk), and interest-rate reset risk.

RISKS

Credit risk in CLOs and synthetic securitizations arises from (1) losses due to defaults by the borrowers in the underlying collateral and (2) the issuer's or servicer's failure to perform. These two elements can blur together, for example, a servicer who does not provide adequate credit-review scrutiny of the serviced portfolio, leading to a higher incidence of defaults. CLOs and synthetic securitizations are rated by major ratings agencies.

Market risk arises from the cash-flow characteristics of the security. The greatest variability in cash flows comes from credit performance, including the presence of wind-down or acceleration features designed to protect the investor in the event that credit losses in the portfolio rise well above expected levels. For certain dynamic CLO structures that allow for active management, adequate disclosure should be made regarding a manager's ability to sell assets that may have appreciated or depreciated in value. This trading flexibility represents an additional level of risk to investors because an investor is exposed to the collateral manager's decisions. As a result, there may be a greater risk in CLOs (versus, for example, credit card securitizations) that its rating can change over time as the composition of the asset pool deteriorates.

Interest-rate risk arises for the issuer from the relationship between the pricing terms on the underlying loans and the terms of the rate paid to noteholders, as well as from the need to mark to market the excess servicing or spread-account proceeds carried on the balance sheet. For the holder of the security, interest-rate risk depends on the expected life or repricing of the security, with relatively minor risk arising from embedded options. The notable exception is the valuation of the wind-down option.

Liquidity risk can arise from credit deterioration in the asset pool when early amortization provisions are triggered. In that situation, the seller's interest is effectively subordinated to the

interests of the other investors by the payment-allocation formula applied during early amortization. Other investors effectively get paid first, and the seller's interest will therefore absorb a disproportionate share of losses. Also, closure of the securitization conduit can create liquidity problems for the seller because the seller must then fund a steady stream of new receivables. When a conduit becomes unavailable due to early amortization, the seller must either find another buyer for the receivables or have receivables accumulate on its balance sheet, creating the need for another source of funding. In addition, these factors can create an incentive for the seller to provide implicit recourse—credit enhancement above and beyond any pre-existing contractual obligation—to prevent early amortization. Although incentives to provide implicit recourse are present in other types of securitizations to some extent, the early-amortization feature of CLOs creates additional and more direct financial incentives to prevent its occurrence because of concerns about damage to the seller's reputation if one of its securitizations performs poorly.

Operational risk arises through the potential for misrepresentation of loan quality or terms by the originating institution, misrepresentation of the nature and current value of the assets by the servicer, and inadequate controls over disbursements and receipts by the servicer.

ACCOUNTING TREATMENT

Holder

The accounting treatment for investments in CLOs and synthetic securitizations is determined by the Financial Accounting Standards Board's Statement of Financial Accounting Standards No. 115 (FAS 115), "Accounting for Certain Investments in Debt and Equity Securities," as amended by Statement of Financial Accounting Standards No. 140 (FAS 140), "Accounting for Transfers and Servicing of Financial Assets and Extinguishments of Liabilities." See section 2120.1, "Accounting," for further discussion.

Seller

FAS 140 covers the accounting treatment for the

securitization of receivables. These standards address (1) when a transaction qualifies as a sale for accounting purposes and (2) the treatment of excess spread and servicing assets arising from a securitization transaction when a sale is deemed to have occurred.

RISK-BASED CAPITAL WEIGHTING

The current capital treatment for the standard master-trust CLO described in this section has three components. First, banks use the low-level-recourse rule when calculating capital charges against any first-loss exposures they retain. Thus, the most junior tranche would carry a dollar-for-dollar capital charge up to 8 percent of the investor interest. Second, banks receive transferor certificates for their investments in the trust through the transferor's interest. As this represents the bank's proportional share in a larger pool of assets, 8 percent capital is held against the transferor's interest. Finally, the loan facilities which the bank has assigned or participated into the trust typically are not fully drawn. The bank maintains capital for its commitment to lend up to the limit of these facilities. If the transferring bank that sponsors the CLO retains a subordinated tranche that would provide credit protection, then the low-level-recourse rule would apply, that is, dollar-for-dollar capital generally would be assessed on the retained risk exposure. This is also true if an interest-only receivable representing the future spread is booked as a receivable on the transferring bank's balance sheet. If the sale of assets is accounted for, in part or in its entirety, as a servicing asset under FAS 140, then the capital charge takes the form of a tier 1 capital limitation. The current capital treatment limits the total amount of mortgage- and nonmortgage-servicing assets that can be included in tier 1 capital to no more than 100 percent. It further limits the amount of nonmortgage-servicing assets that can be included in tier 1 capital to no more than 25 percent.

Examiners should evaluate whether the transferor's interest is of lower credit quality than the investors' interest and, if so, determine whether the 8 percent capital charge against the on-balance-sheet amount is sufficient given the issuing institution's risk exposure. If examiners determine that the transferor's interest is effectively subordinated to the investors' interest and

thus provides credit protection to the issued securities, then the low-level-recourse treatment may be appropriate. SR-96-17, "Supervisory Guidance for Credit Derivatives," provides some guidance for the capital treatment of synthetic securitizations.

Synthetic CLOs can raise questions about the appropriate capital treatment when calculating the risk-based and leverage capital ratios. Capital treatments for three synthetic transactions follow.

Transaction 1—Entire Notional Amount of Reference Portfolio Is Hedged

In the first type of synthetic securitization, the sponsoring banking organization, through a synthetic CLO, hedges the entire notional amount of a reference asset portfolio. An SPV acquires the credit risk on a reference portfolio by purchasing credit-linked notes (CLNs) issued by the sponsoring banking organization. The SPV funds the purchase of the CLNs by issuing a series of notes in several tranches to third-party investors. The investor notes are in effect collateralized by the CLNs. Each CLN represents one obligor and the banking organization's credit-risk exposure to that obligor, which could take the form of bonds, commitments, loans,

and counterparty exposures. Since the noteholders are exposed to the full amount of credit risk associated with the individual reference obligors, all of the credit risk of the reference portfolio is shifted from the sponsoring banking organization to the capital markets. The dollar amount of notes issued to investors equals the notional amount of the reference portfolio. In the example shown in figure 1, this amount is \$1.5 billion.

If the obligor linked to a CLN in the SPV defaults, the sponsoring banking organization will call the individual CLN and redeem it based on the repayment terms specified in the note agreement. The term of each CLN is set so that the credit exposure (to which it is linked) matures before the maturity of the CLN, which ensures that the CLN will be in place for the full term of the exposure to which it is linked.

An investor in the notes issued by the SPV is exposed to the risk of default of the underlying reference assets, as well as to the risk that the sponsoring banking organization will not repay principal at the maturity of the notes. Because of the linkage between the credit quality of the sponsoring banking organization and the issued notes, a downgrade of the sponsor's credit rating most likely will result in the notes also being downgraded. Thus, a banking organization investing in this type of synthetic CLO should assign the notes to the higher of the risk cate-

Figure 1—Transaction 1

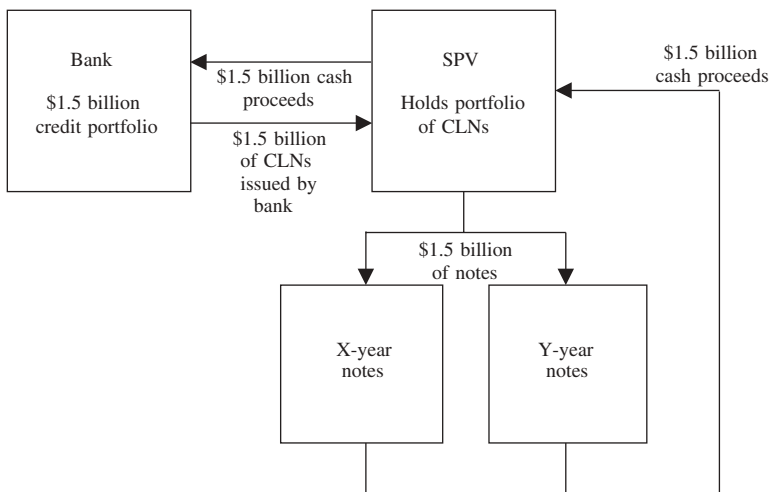
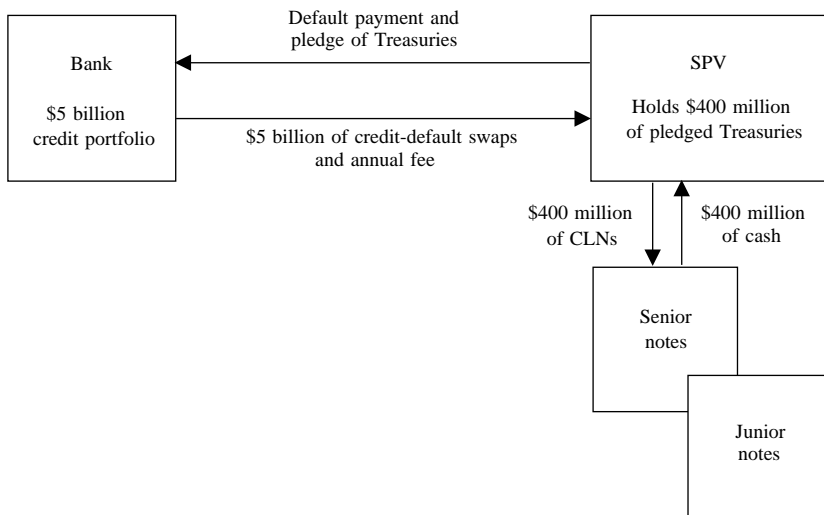


Figure 2—Transaction 2



gories appropriate to the underlying reference assets or the issuing entity.

For purposes of risk-based capital, the sponsoring banking organizations may treat the cash proceeds from the sale of CLNs that provide protection against underlying reference assets as cash collateralizing these assets.⁶ This treatment would permit the reference assets, if carried on the sponsoring banking organization's books, to be assigned to the zero percent risk category to the extent that their notional amount is fully collateralized by cash. This treatment may be applied even if the cash collateral is transferred directly into the general operating funds of the banking organization and is not deposited in a segregated account. The synthetic CLO would not confer any benefits to the sponsoring banking organization for purposes of calculating its tier 1 leverage ratio, however, because the reference assets remain on the organization's balance sheet.

6. The CLNs should not contain terms that would significantly limit the credit protection provided against the underlying reference assets, for example, a materiality threshold that requires a relatively high percentage of loss to occur before CLN payments are adversely affected, or a structuring of CLN post-default payments that does not adequately pass through credit-related losses on the reference assets to investors in the CLNs.

Transaction 2—High-Quality, Senior Risk Position in Reference Portfolio Is Retained

In the second type of synthetic CLO transaction, the sponsoring banking organization hedges a portion of the reference portfolio and retains a high-quality, senior risk position that absorbs only those credit losses in excess of the junior-loss positions. For some noted synthetic CLOs, the sponsoring banking organization used a combination of credit-default swaps and CLNs to transfer to the capital markets the credit risk of a designated portfolio of the organization's credit exposures. Such a transaction allows the sponsoring banking organization to allocate economic capital more efficiently and to significantly reduce its regulatory capital requirements.

In the structure illustrated in figure 2, the sponsoring banking organization purchases default protection from an SPV for a specifically identified portfolio of banking-book credit exposures, which may include letters of credit and loan commitments. The credit risk on the identified reference portfolio (which continues to remain in the sponsor's banking book) is transferred to the SPV through the use of credit-default swaps. In exchange for the credit protection, the sponsoring banking organization

pays the SPV an annual fee. The default swaps on each of the obligors in the reference portfolio are structured to pay the average default losses on all senior unsecured obligations of defaulted borrowers. To support its guarantee, the SPV sells CLNs to investors and uses the cash proceeds to purchase U.S. government Treasury notes. The SPV then pledges the Treasuries to the sponsoring banking organization to cover any default losses.⁷ The CLNs are often issued in multiple tranches of differing seniority and in an aggregate amount that is significantly less than the notional amount of the reference portfolio. The amount of notes issued typically is set at a level sufficient to cover some multiple of expected losses, but well below the notional amount of the reference portfolio being hedged.

There may be several levels of loss in this type of synthetic securitization. The first-loss position may consist of a small cash reserve, sufficient to cover expected losses. The cash reserve accumulates over a period of years and is funded from the excess of the SPV's income (that is, the yield on the Treasury securities plus the credit-default-swap fee) over the interest paid to investors on the notes. The investors in the SPV assume a second-loss position through their investment in the SPV's senior and junior notes, which tend to be rated AAA and BB, respectively. Finally, the sponsoring banking organization retains a high-quality, senior risk position that would absorb any credit losses in the reference portfolio that exceed the first- and second-loss positions.

Typically, no default payments are made until the maturity of the overall transaction, regardless of when a reference obligor defaults. While operationally important to the sponsoring banking organization, this feature has the effect of ignoring the time value of money. Thus, the Federal Reserve expects that when the reference obligor defaults under the terms of the credit derivative and when the reference asset falls significantly in value, the sponsoring banking organization should, in accordance with generally accepted accounting principles, make appropriate adjustments in its regulatory reports to reflect the estimated loss that takes into account the time value of money.

For risk-based capital purposes, the banking organizations investing in the notes must assign them to the risk weight appropriate to the

underlying reference assets.⁸ The sponsoring banking organization must include in its risk-weighted assets its retained senior exposure in the reference portfolio, to the extent these underlying assets are held in its banking book. The portion of the reference portfolio that is collateralized by the pledged Treasury securities may be assigned a zero percent risk weight. Unless the sponsoring banking organization meets the stringent minimum conditions for transaction 2 as outlined in the subsection "Minimum Conditions" (below), the remainder of the portfolio should be risk weighted according to the obligor of the exposures.

When the sponsoring banking organization has virtually eliminated its credit-risk exposure to the reference portfolio through the issuance of CLNs, and when the other minimum requirements are met, the sponsoring banking organization may assign the uncollateralized portion of its retained senior position in the reference portfolio to the 20 percent risk weight. However, to the extent that the reference portfolio includes loans and other on-balance-sheet assets, the sponsoring banking organization would not realize any benefits in the determination of its leverage ratio.

In addition to the three stringent minimum conditions, the Federal Reserve may impose other requirements as it deems necessary to ensure that a sponsoring banking organization has virtually eliminated all of its credit exposure. Furthermore, the Federal Reserve retains the discretion to increase the risk-based capital requirement assessed against the retained senior exposure in these structures if the underlying asset pool deteriorates significantly.

Federal Reserve staff will make a case-by-case determination, based on a qualitative review, as to whether the senior retained portion of a sponsoring banking organization's synthetic securitization qualifies for the 20 percent risk weight. The sponsoring banking organization must be able to demonstrate that virtually all the credit risk of the reference portfolio has been transferred from the banking book to the capital markets. As they do when banking organizations are engaging in more traditional securiti-

7. The names of corporate obligors included in the reference portfolio may be disclosed to investors in the CLNs.

8. Under this type of transaction, if a structure exposes investing banking organizations to the creditworthiness of a substantive issuer, for example, the sponsoring banking organization, then the investing banking organizations should assign the notes to the higher of the risk categories appropriate to the underlying reference assets or the sponsoring banking organization.

zation activities, examiners must carefully evaluate whether the sponsoring banking organization is fully capable of assessing the credit risk it retains in its banking book and whether it is adequately capitalized given its residual risk exposure. The Federal Reserve will require the sponsoring banking organization to maintain higher levels of capital if it is not deemed to be adequately capitalized given the retained residual risks. In addition, a sponsoring banking organization involved in synthetic securitizations must adequately disclose to the marketplace the effect of its transactions on its risk profile and capital adequacy.

The Federal Reserve may consider a sponsoring banking organization's failure to require the investors in the CLNs to absorb the credit losses that they contractually agreed to assume to be an unsafe and unsound banking practice. In addition, such a failure generally would constitute "implicit recourse" or support to the transaction, which results in the sponsoring banking organization's losing preferential capital treatment on its retained senior position.

If a sponsoring banking organization of a synthetic securitization does not meet the stringent minimum conditions, it may still reduce the risk-based capital requirement on the senior risk position retained in the banking book by transferring the remaining credit risk to a third-party OECD bank through the use of a credit derivative. Provided the credit-derivative transaction qualifies as a guarantee under the risk-based capital guidelines, the risk weight on the senior position may be reduced from 100 percent to 20 percent. Sponsoring banking organizations may not enter into nonsubstantive transactions that transfer banking-book items into the trading account to obtain lower regulatory capital requirements.⁹

Minimum Conditions

The following stringent minimum conditions are those that the sponsoring banking organizations must meet to use the synthetic securitization capital treatment for transaction 2. The Federal

9. For instance, a lower risk weight would not be applied to a nonsubstantive transaction in which the sponsoring banking organization (1) enters into a credit-derivative transaction to pass the credit risk of the senior retained portion held in its banking book to an OECD bank, and then (2) enters into a second credit-derivative transaction with the same OECD bank, in which it reassumes into its trading account the credit risk initially transferred.

Reserve may impose additional requirements or conditions as deemed necessary to ascertain that a sponsoring banking organization has sufficiently isolated itself from the credit-risk exposure of the hedged reference portfolio.

Condition 1—Demonstration of transfer of virtually all the risk to third parties. Not all transactions structured as synthetic securitizations transfer the level of credit risk needed to receive the 20 percent risk weight on the retained senior position. To demonstrate that a transfer of virtually all of the risk has been achieved, sponsoring banking organizations must—

- produce credible analyses indicating a transfer of virtually all the credit risk to substantive third parties;
- ensure the absence of any early-amortization or other credit-performance-contingent clauses;¹⁰
- subject the transaction to market discipline through the issuance of a substantive amount of notes or securities to the capital markets;
- have notes or securities rated by a nationally recognized credit rating agency;
- structure a senior class of notes that receives the highest possible investment-grade rating, for example, AAA, from a nationally recognized credit rating agency;
- ensure that any first-loss position they retain in the form of fees, reserves, or other credit enhancement—which effectively must be deducted from capital—is no greater than a reasonable estimate of expected losses on the reference portfolio; and
- ensure that they do not reassume any credit risk beyond the first-loss position through another credit derivative or any other means.

Condition 2—Demonstration of ability to evaluate remaining banking-book risk exposures and provide adequate capital support. To ensure that the sponsoring banking organization has adequate capital for the credit risk of its unhedged exposures, it is expected to have adequate systems that fully account for the effect of these transactions on its risk profiles and capital adequacy. In particular, the sponsoring banking organiza-

10. Early-amortization clauses may generally be defined as features that are designed to force a wind-down of a securitization program and rapid repayment of principal to asset-backed securities investors if the credit quality of the underlying asset pool deteriorates significantly.

tion's systems should be capable of fully differentiating the nature and quality of the risk exposures it transfers from the nature and quality of the risk exposures it retains. Specifically, to gain capital relief sponsoring banking organizations are expected to—

- have a credible internal process for grading credit-risk exposures, including the following:
 - adequate differentiation of risk among risk grades
 - adequate controls to ensure the objectivity and consistency of the rating process
 - analysis or evidence supporting the accuracy or appropriateness of the risk-grading system;
- have a credible internal economic capital-assessment process that defines them to be adequately capitalized at an appropriate insolvency probability and that readjusts, as necessary, their internal economic capital requirements to take into account the effect of the synthetic securitization transaction. (In addition, the process should employ a sufficiently long time horizon to allow necessary adjustments in the event of significant losses. The results of an exercise demonstrating that the organization is adequately capitalized after the securitization transaction must be presented for examiner review.);
- evaluate the effect of the transaction on the nature and distribution of the nontransferred banking-book exposures. This analysis should include a comparison of the banking book's risk profile and economic capital requirements before and after the transaction, including the mix of exposures by risk grade and by business or economic sector. (The analysis should also identify any concentrations of credit risk and maturity mismatches. Additionally, the sponsoring banking organization must adequately manage and control the forward credit exposure that arises from any maturity mismatch. The Federal Reserve retains the flexibility to require additional regulatory capital if the maturity mismatches are substantive enough to raise a supervisory concern. Moreover, as stated above, the sponsoring banking organization must demonstrate that it meets its internal economic capital requirement subsequent to the completion of the synthetic securitization.); and
- perform rigorous and robust forward-looking stress testing on nontransferred exposures (remaining banking-book loans and commit-

ments), transferred exposures, and exposures retained to facilitate transfers (credit enhancements). The stress tests must demonstrate that the level of credit enhancement is sufficient to protect the sponsoring banking organization from losses under scenarios appropriate to the specific transaction.

Condition 3—Provide adequate public disclosures of synthetic CLO transactions regarding their risk profile and capital adequacy. In their 10-K and annual reports, sponsoring banking organizations must adequately disclose to the marketplace the accounting, economic, and regulatory consequences of synthetic CLO transactions. In particular, sponsoring banking organizations are expected to disclose—

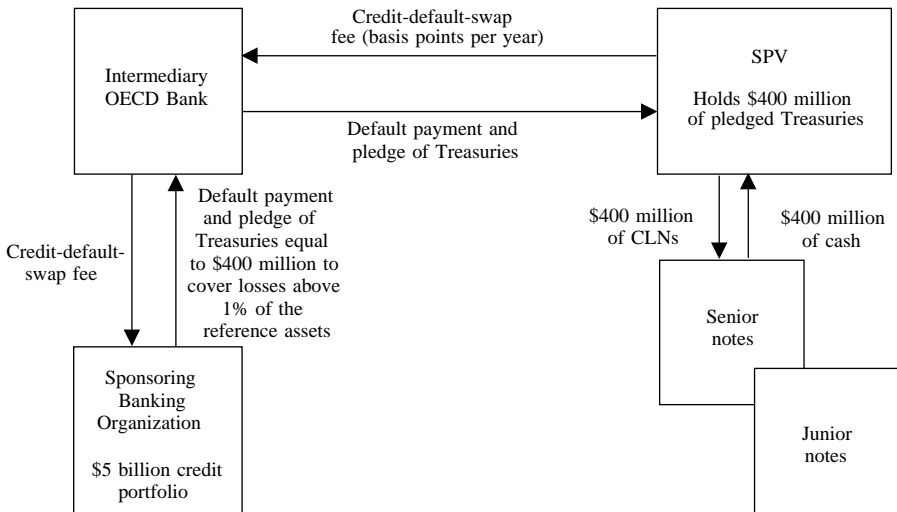
- the notional amount of loans and commitments involved in the transaction;
- the amount of economic capital shed through the transaction;
- the amount of reduction in risk-weighted assets and regulatory capital resulting from the transaction, both in dollar terms and in terms of the effect in basis points on the risk-based capital ratios; and
- the effect of the transaction on the distribution and concentration of risk in the retained portfolio by risk grade and sector.

Transaction 3—First-Loss Position Is Retained

In the third type of synthetic transaction, the sponsoring banking organization may retain a subordinated position that absorbs the credit risk associated with a first loss in a reference portfolio. Furthermore, through the use of credit-default swaps, the sponsoring banking organization may pass the second- and senior-loss positions to a third-party entity, most often an OECD bank. The third-party entity, acting as an intermediary, enters into offsetting credit-default swaps with an SPV, thus transferring its credit risk associated with the second-loss position to the SPV.¹¹ The SPV then issues CLNs to the capital markets for a portion of the reference

11. Because the credit risk of the senior position is not transferred to the capital markets but remains with the intermediary bank, the sponsoring banking organization should ensure that its counterparty is of high credit quality, for example, at least investment grade.

Figure 3—Transaction 3



portfolio and purchases Treasury collateral to cover some multiple of expected losses on the underlying exposures.

Two alternative approaches could be used to determine how the sponsoring banking organization should treat the overall transaction for risk-based capital purposes. The first approach employs an analogy to the low-level-capital rule for assets sold with recourse. Under this rule, a transfer of assets with recourse that contractually is limited to an amount less than the effective risk-based capital requirements for the transferred assets is assessed a total capital charge equal to the maximum amount of loss possible under the recourse obligation. If this rule applied to a sponsoring banking organization retaining a 1 percent first-loss position on a synthetically securitized portfolio that would otherwise be assessed 8 percent capital, the sponsoring banking organization would be required to hold dollar-for-dollar capital against the 1 percent first-loss risk position. The sponsoring banking organization would not be assessed a capital charge against the second- and senior-risk positions.¹²

12. The sponsoring banking organization would not realize any benefits in the determination of its leverage ratio since the reference assets remain on its balance sheet.

The second approach employs a literal reading of the capital guidelines to determine the sponsoring banking organization's risk-based capital charge. In this instance, the 1 percent first-loss position retained by the sponsoring banking organization would be treated as a guarantee, that is, a direct credit substitute, which would be assessed an 8 percent capital charge against its face value of 1 percent. The second-loss position, which is collateralized by Treasury securities, would be viewed as fully collateralized and subject to a zero percent capital charge. The senior-loss position guaranteed by the intermediary bank would be assigned to the 20 percent risk category appropriate to claims guaranteed by OECD banks.¹³

The second approach may result in a higher risk-based capital requirement than the dollar-for-dollar capital charge imposed by the first approach, depending on whether the reference

13. If the intermediary is a banking organization, then it could place both sets of credit-default swaps in its trading account and, if subject to the Federal Reserve's market-risk capital rules, use its general market-risk model and, if approved, specific-risk model to calculate the appropriate risk-based capital requirement. If the specific-risk model has not been approved, then the sponsoring banking organization would be subject to the standardized specific-risk capital charge.

portfolio consists primarily of loans to private obligors or undrawn long-term commitments. The latter generally have an effective risk-based capital requirement one-half of the requirement for loans because these commitments are converted to an on-balance-sheet credit-equivalent amount using the 50 percent conversion factor. If the reference pool consists primarily of drawn loans to private obligors, then the capital requirement on the senior-loss position would be significantly higher than if the reference portfolio contained only undrawn long-term commitments. As a result, the capital charge for the overall transaction could be greater than the dollar-for-dollar capital requirement set forth in the first approach.

Sponsoring banking organizations will be required to hold capital against a retained first-loss position in a synthetic securitization equal to the higher of the two capital charges resulting from application of the first and second approaches, as discussed above. Further, although the sponsoring banking organization retains only the credit risk associated with the first-loss position, it still should continue to monitor all the underlying credit exposures of the reference portfolio to detect any changes in the credit-risk profile of the counterparties. This is important to ensure that the sponsoring banking organization has adequate capital to protect against unexpected losses. Examiners should determine whether the sponsoring banking organization has the capability to assess and manage the retained risk in its credit portfolio after the synthetic securitization is completed. For risk-based capital purposes, banking organizations investing in the notes must assign them to the risk weight appropriate to the underlying reference assets.¹⁴

LEGAL LIMITATIONS FOR BANK INVESTMENTS

Asset-backed securities can be either type IV or type V securities. Type IV securities include the following asset-backed securities that are fully

secured by interests in a pool (or pools) of loans made to numerous obligors:

- investment-grade residential-mortgage-related securities offered or sold pursuant to section 4(5) of the Securities Act of 1933 (15 USC 77d(5))
- residential-mortgage-related securities as described in section 3(a)(41) of the Securities Exchange Act of 1934 (15 USC 78c(a)(41)) that are rated in one of the two highest investment-grade rating categories
- investment-grade commercial mortgage securities offered or sold pursuant to section 4(5) of the Securities Act of 1933 (15 USC 77d(5))
- commercial mortgage securities as described in section 3(a)(41) of the Securities Exchange Act of 1934 (15 USC 78c(a)(41)) that are rated in one of the two highest investment-grade rating categories
- investment-grade, small-business-loan securities as described in section 3(a)(53)(A) of the Securities Exchange Act of 1934 (15 USC 78(a)(53)(A))

Type V securities consist of all asset-backed securities that are not type IV securities. Specifically, they are defined as marketable, investment-grade-rated securities that are not type IV and are “fully secured by interests in a pool of loans to numerous obligors and in which a national bank could invest directly.” CLOs and synthetic securitizations are generally classified as type V securities. A bank may purchase or sell type V securities for its own account provided the aggregate par value of type V securities issued by any one issuer held by the bank does not exceed 25 percent of the bank’s capital and surplus.

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¹⁴. Under this type of transaction, if a structure exposes investing banking organizations to the creditworthiness of a substantive issuer, for example, the sponsoring banking organization, then the investing banking organizations should assign the notes to the higher of the risk categories appropriate to the underlying reference assets or the sponsoring banking organization.

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GENERAL DESCRIPTION

The term *commodity-linked transaction* is used to denote all transactions that have a return linked to the price of a particular commodity or to an index of commodity prices. The term *commodity-derivative transaction* refers exclusively to transactions that have a return linked to commodity prices or indexes and for which there is no exchange of principal.

The term *commodity* encompasses both traditional agricultural products, base metals, and energy products, so that all those transactions that cannot be characterized as interest or exchange-rate contracts under the Basle Accord are designated commodity transactions. Precious metals, which have been placed into the foreign-exchange-rate category in deference to market convention, are not included.

CHARACTERISTICS AND FEATURES

A commodity-linked contract specifies exactly the type or grade of the commodity, the amount, and the future delivery or settlement dates. In these transactions, the interest, principal, or both, or the payment streams in the case of swaps, is linked to a price of a commodity or related index. However, given that banks are not allowed to trade in the underlying physical commodity (with the exception of gold) without special permission, these contracts are settled for cash.

Factors that affect commodity prices and risk are numerous and of many different origins. Macroeconomic conditions, local disturbances, weather, supply and demand imbalances, and labor strikes are examples of factors that have a direct impact on commodity prices. In many other traded markets, such factors would have a more indirect effect.

USES

Commodity-linked markets offer participants a way to hedge or take positions in future commodity prices. Market participants include commodity producers or users, such as mining,

energy, and transportation companies, that want to lock in future costs or revenues by entering into a contract at a given price.

In general, financial institutions view commodity-linked transactions as a financial risk-management service for customers with commodity-price exposure, similar to the foreign-exchange and interest-rate risk management products that banks have historically offered. Over-the-counter (OTC) transactions can be tailored to the customer's needs and, therefore, offer more flexibility than exchange-traded contracts, particularly for longer-term insurance.

Examples of commodity-linked products offered by banks include commodity-linked deposits, commodity-linked loans, commodity-linked swaps, and commodity-linked options. Examples of these products and the ways in which hedgers and speculators use these products are described below.

Commodity-Linked Deposits

The following is an example of a deposit with the return linked to a commodity index:

A \$100,000 one-year deposit has a return linked to the price of oil. The deposit pays at maturity either (1) a guaranteed minimum return of 3 percent or (2) 90 percent of any gain in the market index (relative to an index rate set at the outset of the transaction) of oil over the life of the deposit, whichever is greater. The depositor is able to benefit from a rise in the price of oil (however, by only 90 percent of the rise that would have been received if he or she had purchased the physical oil). The asset is less risky compared to the purchase of the actual physical oil because the principal is protected against a fall in the price of oil.

Commodity-Linked Loans

The following is an example of a loan with interest payments linked to a commodity index:

A financial institution lends an oil company \$1 million for five years with interest payments linked to the price of oil as opposed to a conventional loan at 8 percent. The initial oil

index is set at \$20 per barrel. Interest payments are the greater of 4 percent or the excess of any gain in the market price of oil relative to the \$20 per barrel base, up to a maximum of 25 percent. The borrower pays a lower interest rate compared to a non-commodity-linked loan when oil prices fall, but shares the upside potential of its oil revenues with the lender when the price of oil rises.

Commodity-Linked Swaps

Commodity-linked swaps are defined as an agreement between two counterparties to make periodic exchanges of cash based on the following terms:

- notional quantity (for example, number of barrels or tons) of the specified commodity
- index, based on a defined grade and type of commodity, whose prevailing price is publicly quoted
- fixed price agreed to by the counterparties (The fixed price is usually above the spot price per unit for the defined commodity at the date the swap is consummated.)
- at specified intervals during the term of the swap, there are settlement dates at which the counterparties agree to a net exchange of cash (The amount of cash to be exchanged is determined as follows:
 - One counterparty is the fixed price payer. At each settlement date, the fixed price payer owes the counterparty the notional amount of the contract multiplied by the fixed price.
 - The other counterparty is the floating-rate price payer. At each settlement date, the floating price payer owes the counterparty the notional amount multiplied by the index price prevailing on the settlement date.)

As an example, suppose an oil company wishes to protect itself against a decline in oil prices and enters into a commodity-swap agreement with a bank. The company will receive a fixed price and pay a floating price linked to an index of the price of oil. Thus, the company trades the upside potential of rising oil prices for the assurance that it will not receive a price below the fixed price agreed on at the inception of the trade.

As a further example, suppose a utility company wishes to protect itself from rising oil prices and enters into a commodity-swap agreement with a bank. The utility company will pay a fixed price and receive a floating price linked to an index of the price of oil. Thus, the utility trades its upside potential if oil prices fall for the assurance that it will not pay a price above that agreed on at the inception of the trade.

Commodity-Linked Options

Commodity-linked options convey the right to buy (call) or sell (put) the cash-equivalent amount of an underlying commodity at a fixed exercise price (there is no physical delivery of the underlying commodity). The purchase of a commodity-linked call by an oil user, for example, sets a cap on the price of oil that the user will pay. If oil prices rise, the oil user will exercise the call option, which is the right to buy oil at the lower exercise price. The seller of a call option may have a long position in a given underlying commodity, thus selling off the upside potential of the commodity in exchange for the premium paid by the purchaser of the call.

The purchase by an oil producer of a put option indexed to the price of oil sets a floor on the price of oil that the producer will receive. The bought put therefore allows the holder to establish a minimum price level on the underlying commodity. If the price of oil in the open market falls below the strike price of the option, the oil producer will exercise the put to lock in the strike price.

DESCRIPTION OF MARKETPLACE

Commodity-linked derivatives are traded in both the exchange and OTC markets. There are several fundamental differences between the futures exchanges and the OTC markets for commodities. First, futures contracts may entail delivery of the physical commodity upon expiration of the contract, whereas OTC contracts generally are settled for cash. Second, futures contracts are standardized, while OTC contracts are tailored, often specifying commodities and maturities that are not offered on the exchanges. Third, the OTC market typically handles only large transactions, whereas exchanges may

accommodate transactions as small as the value of a single contract in a given commodity. As a result, the OTC commodity markets tend to be less liquid than the exchanges, but at the same time they offer products that can be more customized to meet the users' specific needs.

Market Participants

Primary players in the commodity markets are commodity producers and end-users, hedge funds and mutual funds, and investment and commercial banks. Commercial banks are relatively small players in the commodity markets; it is estimated that they account for roughly 5 to 10 percent of trading activity in the domestic energy sector and even less in agricultural commodities. However, these banks fill an important niche by acting as intermediaries between producers and users of oil and gas products, which is also important for market participants. Banks apply tested risk-management techniques and market-making skills, which has helped to increase liquidity in the markets. Additionally, the ability of banks, acting as financial intermediaries, to transform risks has enabled entities to hedge attendant exposures (for example, credit risk) which are a component of energy transactions, though not directly related to the price of energy.

Market Transparency

For all exchange-traded commodity products, transparency is high. In the OTC markets, wide variations of transparency exist based on the product, volume traded, grade, delivery point, maturity, and other factors.

PRICING

Similar to the term structure of interest rates, commodity price curves exist which convey information about future expectations. In addition, they reflect the prevailing yield curve (cost-of-carry) and storage costs.

Energy prices are said to be in "contango" when the forward prices are greater than expected spot prices at some future date; prices are said to be in "backwardation" when future spot prices exceed forward prices. The term structure has

little forecasting power, however. Forward prices have not been proven to be accurate forecasts of future spot prices.

The theory of contango holds that the natural hedgers are the purchasers of a commodity, rather than the suppliers. In the case of wheat, grain processors would be viewed as willing to pay a premium to lock in the price that they must pay for wheat. Because long hedgers will agree to pay high futures prices to shed risk, and because speculators require a premium to enter into the short position, the contango theory holds that forward prices must exceed the expected future spot price.

The contrasting theory of contango is backwardation. This theory states that natural hedgers for most commodities will want to shed risk, such as wheat farmers who want to lock in future wheat prices. These farmers will take short positions to deliver wheat in the future at a guaranteed price. To induce speculators to take the corresponding long positions, the farmers need to offer speculators an expectation of profit. The theory of backwardation suggests that future prices will be bid down to a level below the expected spot price.

Any commodity will have both natural long hedgers and short hedgers. The compromise traditional view, called the "net hedging hypothesis," is that the forward price will be less than the expected future spot price when short hedgers outnumber long hedgers and vice versa. The side with the most natural hedgers will have to pay a premium to induce speculators to enter into enough contracts to balance the natural supply of long and short hedgers.

The future price of an energy product is determined by many factors. The no-arbitrage, cost-of-carry model predicts that futures prices will differ from spot prices by the storage and financing costs relevant to inventory. The future spot price is the only source of uncertainty in the basic model. Carry is the sum of the riskless interest rate and the marginal cost of storage. Because carry is always positive, the cost-of-carry model predicts that energy prices will always be in contango.

Empirical evidence suggests, however, that the term structure of energy is not fully explained by carry. The term structure of energy prices is not always in contango. Oil and natural gas markets often become backwardated due to external factors or supply concerns. Further, the market rarely shows full carrying charges. In other words, futures prices as predicted by a

cost-of-carry model generally exceed those observed in the market, even when prices are in contango.

HEDGING

Participants in the OTC commodity markets may have more difficulty hedging their positions than participants in the foreign-exchange and interest-rate markets because of the shallowness and illiquidity of OTC commodity markets. It is also difficult to match the terms and maturities of exchange-traded futures hedges with OTC commodities instruments.

To hedge the spot risk associated with commodity-linked transactions, traders will offset a long position with a short position. The choice of the hedge instrument used generally depends on (1) market conditions, that is, whether the financial institution has a natural offsetting position; (2) the risk appetite of the institution; and (3) cost. Because exchange-traded futures contracts are standardized, they are usually cheaper than the equivalent OTC contracts and are normally the preferred hedge instrument. However, the margin and collateral requirements of exchange-traded contracts may mean that OTC contracts have lower transactions costs than futures traded on exchanges. Moreover, the terms of a futures contract will rarely be identical to the terms of an OTC contract, leaving the financial institution with residual risk.

Commodity swaps, in particular, may be entered into on a perfectly matched basis, with the financial institution guaranteeing the payments of two parties with equal and opposite interests. In a perfectly matched transaction, the financial institution writes a separate, offsetting long-term swap contract with each party, incorporating a margin to cover costs and the risk of counterparty default, and closes simultaneously both sides of the transaction. When engaging in matched commodity swaps, a financial institution is exposed to commodity-price risk only when the counterparty on one side of a matched transaction defaults, and the financial institution must enter the market to hedge or rebalance its book.

However, the need to match transactions perfectly at all times would limit the ability of financial institutions to serve their customers and to compete in the existing market. For

example, if a financial institution enters into swap agreements for its own account with one counterparty, it may not be able to establish a matching offsetting transaction immediately. Therefore, it may wish to hedge its commodity-price risk in the futures or related markets until an offsetting swap can be written. When an exact offset is found, the two swaps are matched and the hedge position is unwound.

Some financial institutions may seek a matched book by the end of the day, while others are willing to carry an open swap for weeks or to rely on other hedging techniques, such as hedging on a portfolio basis. For example, a financial institution may hedge the commodity-price exposure of the entire portfolio of independently contracted swaps without ever seeking exactly offsetting transactions. Hedging models help to determine the amount of exposure already offset by the transactions currently in the book. The residual exposure is then hedged using exchange-traded futures and options so that it is reduced to less than the position limits established by the financial institution's management. Some of the most serious financial-institution participants in the commodity swap market are hedging on a portfolio basis.

The use of futures and options to hedge an individual commodity-linked transaction, or a portfolio of such transactions, does not eliminate the residual basis risk resulting from differences between the movements in the prices of two commodities used to offset one another. When risk managers or traders cannot profitably execute a hedge in the same commodity, they may use a second commodity whose price tends to move in line with the first. Such a hedge is necessarily imperfect and cannot eliminate all risk. For example, prospective oil hedgers may incur basis risk because of discrepancies between the nature of the underlying instrument (for example, a crude oil futures contract versus a jet fuel swap) or the location of the deliverable-grade commodity (for example, North Sea oil versus West Texas Intermediate oil).

RISKS

Many of the risks associated with commodity-linked activities are similar to those connected with interest-rate and foreign-exchange products. Price, counterparty credit, and delivery risks all exist. In the case of commodity-linked

transactions, these risks may be further exaggerated because of illiquidity, volatility, and forward pricing problems.

Basis Risk

One of the primary risks facing investors in commodity-linked transactions is basis risk—the risk of a movement in the price of a specific commodity relative to a movement in the price of the commodity-linked transaction. The definition of commodity that is often used to signify like, interchangeable products cannot be applied freely. Variances of grade, delivery location, and delivery time frame—among other things—give rise to numerous basis issues that must be carefully managed. Price risk can be reduced by hedging with either exchange-traded or OTC contracts. However, if contract terms are not equivalent, substantial basis risk can result. Types of basis risk include, but are not limited to, grade risk, location risk, calendar (nearby-versus deferred-month) risk, stack-and-roll risk (hedging deferred obligations in nearby months on a rolling basis), and, in the energy markets, risks associated with crack spreads (the price differential between refined and unrefined products).

Liquidity Risk

The OTC commodity derivative markets are generally much less liquid than the foreign-exchange and interest-rate derivative markets; commodity-linked derivative products are currently offered by relatively few financial institutions. As a result of the shallow nature of the market, liquidity usually drops off for contracts on forward prices beyond one year.

In addition to their relative scarcity, OTC commodity-linked transactions are customized to meet the needs of the user. This characteristic of the market exacerbates the ability of a financial institution to hedge commodity-linked derivative transactions; perfectly offsetting instruments are rarely available in the OTC market, and there may be a significant degree of basis risk when hedging with exchange-traded instruments. For purposes of hedging long-dated

(more than one year) crude oil, the OTC market is superior to exchange-traded markets in terms of liquidity.

Volatility Risk

Commodity prices can be much more volatile than interest rates or foreign-currency rates, although this volatility is sensitive to the time period and market conditions. The smaller size of the commodity markets is partially responsible for the heightened volatility of commodity prices. Changes in supply or demand can have a more dramatic effect on prices in smaller markets, as reflected in the measured volatility. Thus, a disruption in any one source of supply may greatly affect the price since many commodities are dominated by only a few suppliers. In addition, the fact that only a few suppliers exist can result in prices that are subject to manipulation. Demand for commodities can also depend heavily on economic cycles.

ACCOUNTING TREATMENT

The accounting treatment for commodity-linked transactions is determined by the Financial Accounting Standards Board's Statement of Financial Accounting Standards No. 133 (FAS 133), "Accounting for Derivatives and Hedging Activities," as amended by Statement of Financial Accounting Standards Nos. 137 and 138 (FAS 137 and FAS 138). (See section 2120.1, "Accounting," for further discussion.)

RISK-BASED CAPITAL WEIGHTING

The credit-equivalent amount of a commodity-linked contract is calculated by summing—

1. the mark-to-market value (positive values only) of the contract and
2. an estimate of the potential future credit exposure over the remaining life of each contract.

The conversion factors are as follows.

	<i>0–1 years</i>	<i>1–5 years</i>	<i>Over 5 years</i>
Gold contracts	1.0%	5.0%	7.5%
Other precious metals	7.0%	7.0%	8.0%
Other commodities	10.0%	12.0%	15.0%

If a bank has multiple contracts with a counterparty and a qualifying bilateral contract with the counterparty, the bank may establish its current and potential credit exposures as net credit exposures. (See section 2110.1, “Capital Adequacy.”)

LEGAL LIMITATIONS FOR BANK INVESTMENT

Commodity derivatives are not considered investments under 12 USC 24 (seventh). A bank must receive proper regulatory approvals before engaging in commodity-linked activities.

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