Are Derivatives Too Risky for Banks?

By Sean Becketti

Bank participation in the market for derivatives has been growing rapidly in recent years. Derivatives such as swaps, futures, and options now form a significant share of total assets at some of the nation's largest banks. Moreover, participation in these markets accounts for a growing share of bank revenues.

Some observers worry that derivatives may be too risky for banks, because derivatives are relatively new and complex assets. In a 1992 speech to the New York Bankers Association, E. Gerald Corrigan, then-president of the Federal Reserve Bank of New York, warned that the growth and complexity of derivatives activities "should give us all cause for concern." And in April of this year, prominent investor Warren Buffet worried that derivatives might one day trigger a catastrophic "chain reaction" in world financial markets.

In light of these concerns, it is relevant to ask whether banks should be prohibited from participating in derivatives markets. Laws and regulations already restrict many bank activities to protect depositors and ensure the integrity and stability of the payments system. For example, most investment banking activities are barred by the Glass-Steagall Act, and banks are prohibited from buying corporate stocks for their own accounts because stocks are considered too risky. Some observers believe that derivatives, like corporate stocks, may be too risky for banks to deal in or to hold.

This article examines whether derivatives are too risky for banks at the current stage of market development. The first section defines derivatives and explains their uses. The next section examines the role of banks in the derivatives market, traces the growth of bank participation in the market, and considers the reasons for this increased participation. The third section describes the risks derivatives pose to banks and discusses how banks are managing these risks. The fourth section explains how regulators monitor banks' derivatives activities. The article concludes with the view that banks can safely manage and regulators can effectively supervise bank participation in derivatives markets.

DERIVATIVES DEFINED

Derivatives are financial contracts whose values are derived from the values of other underlying assets, such as foreign exchange, bonds, equities, or commodities. Because their values are related to these underlying assets and because they have certain other characteristics, derivatives are useful for hedging, speculating, arbitraging price differences, and adjusting portfolios at low cost.

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What are derivatives?

A derivative is a financial contract whose value depends on the value of an underlying asset or index of asset values.[1]

For example, an interest rate futures contract is a derivative that commits the parties to exchange a debt security, say a Treasury bond, at a future date for a predetermined price. The value of the futures contract depends on the value of the Treasury bond that underlies it. If the Treasury bond price rises, the value of the futures contract also rises because the buyer of the futures contract is now entitled to receive a more valuable asset.

The enormous and rapidly growing variety of derivatives can be bewildering even to experienced financial market participants. But all derivatives can be classified according to three features: the type of contract, the type of asset underlying the security, and whether the derivative is traded on an exchange or in the over-the-counter (OTC) market.

Banks trade mainly in the following three types of derivatives contracts. *Forward and futures contracts* are agreements between two parties to exchange a quantity of assets at a future date at a predetermined price.[2] The Treasury bond futures contract mentioned above is an example of this type of contract.

Options contracts confer the right, but not the obligation, to buy or sell an asset at a predetermined price on or before a fixed expiration date. For instance, a call option on IBM stock confers the right to purchase some number of IBM shares at a predetermined price on or before the expiration date. Conversely, a put option confers the right to sell the shares at a predetermined price on or before the expiration date.

Swaps are agreements between two parties to exchange cash flows in the future according to a prearranged formula. In an interest rate swap, for example, one party agrees to pay the other party a sequence of fixed cash flows in exchange for a sequence of variable cash flows. The fixed cash flows are equal to the interest payments that would be associated with a hypothetical fixed-rate loan. The principal in this hypothetical loan is called the notional principal and is used as a measure of the size of the swap. The variable payments are equal to the interest payments that would be associated with a floating-rate loan with the same notional principal.[3]

Most derivatives are based on one of four types of underlying assets: foreign exchange, interest rates (that is, debt securities), commodities, and equities. Examples of derivatives based on each of these different types of underlying assets are forward contracts for foreign exchange, interest rate swaps, wheat futures, and options on equities.

Some derivatives are traded on organized exchanges, while others are traded only in the OTC market. Exchange-traded derivatives are standardized contracts—that is, these contracts have standardized features and are not tailored to the needs of individual buyers and sellers. For example, S&P 500 stock index futures are traded on the Chicago Mercantile Exchange. The value of these futures contracts is tied to the Standard & Poor's Composite Stock Price Index. The futures expire four times a year, and the exchange prescribes rules for settling any outstanding contracts in cash on the expiration dates. In contrast, OTC derivatives are customized to meet the specific needs of the counterparties. Swaps are the leading example of OTC derivatives. The terms of, say, an interest rate swap—the fixed and floating interest rates, the notional principal, the term of the sequence of payments—are determined to suit the two counterparties.

Another important difference between exchange-traded and OTC derivatives is their credit risk. In the OTC market, a derivatives investor is exposed to the risk that his counterparty may default on the contract. In the market for exchange-traded derivatives, though, credit risk is controlled by the exchanges which act as a clearinghouse for all trades and set margin requirements. When a futures contract is traded

on an exchange, for instance, the exchange simultaneously sells the contract to the buyer and buys the same contract from the seller. The buyer and seller trade with the exchange rather than with each other. As a consequence, the buyer and seller need not worry about each other's creditworthiness. The exchange protects itself by requiring traders to maintain margins large enough to cover most one-day movements in prices. In exceptionally volatile markets, exchanges may even require traders to post additional margin during the trading day. Because of these mechanisms, losses on exchanges due to defaults have been almost nonexistent (Hull).

The characteristics of derivatives

Derivatives have grown in popularity because they offer a combination of characteristics not found in other assets. The most important characteristic of derivatives is the close relationship between their values and the values of their underlying assets. There are three other characteristics that distinguish derivatives from underlying assets and make them useful for a variety of purposes. It is easier to take a short position in derivatives than in other assets; exchange-traded derivatives are liquid and have low transactions costs; and, it is possible to construct or combine derivatives to closely match specific portfolio requirements.

Relationship between the values of derivatives and their underlying assets. When the values of underlying assets change, so do the values of the derivatives based on them. For some derivatives, such as most swaps and futures, the relationship between the values of the underlying asset and the derivative is straightforward. In a Treasury bond futures contract, the price to be paid when the bond is delivered is fixed by the futures contract, but the value of the bond to be delivered fluctuates. Thus, the value of the futures contract fluctuates with the value of the Treasury bond. The relationship between the values of an underlying asset and an option on that asset is more complicated, but the values of the option and the underlying asset are still associated.[4]

Short positions. An investor is said to have a short position in an asset if he is obligated to deliver the asset in the future. For example, an investor can short a stock by temporarily borrowing and then selling the stock. This investor will profit if the stock price falls before he must return it to the lender. An investor is said to have a long position in an asset if he either currently owns or is entitled to future delivery of the asset.

It is easier to take a short position in derivatives than in other assets. To short stocks or bonds, for example, an investor must find someone who owns the needed quantity of the asset and is willing to lend it to the short seller. Shorting a futures contract or an option is more straightforward. Every futures or options trade results in one party who is long (who buys the derivative) and one party who is short (who sells the derivative). Since the underlying asset is not exchanged when a derivative security is bought and sold, there is no need to find asset holders willing to lend their securities.[5]

Liquidity and transactions costs. Exchange-traded derivatives are more liquid and have lower transactions costs than other assets. They are more liquid because they have standardized terms, low credit risk, and interest in the underlying assets is broad (Remolona). Furthermore, their transactions costs are low. For example, Kling presents evidence that

> ...the transaction cost for buying a diversified portfolio of common stock is dramatically lower using the futures market than using the cash market. For Treasury securities, costs are lower in the futures market as well, although the difference between cash and futures transaction costs is not as striking as in the stock market.

In addition, margin requirements for exchange-traded derivatives are relatively low, reflecting the relatively low level of credit risk associated with these derivatives (Hull; Morris

1989a, 1989b). In a stronger statement, Miller claims that futures contracts "are designed and introduced by exchanges with basically one consideration in mind: low-cost trading."

In contrast, customized terms and the lack of a clearinghouse make OTC derivatives relatively illiquid. As a consequence, counterparties to OTC derivatives may be unable to withdraw from their contracts if their portfolio needs change. In this circumstance, the counterparty wishing to withdraw must undertake an offsetting trade while keeping the original contract in place.

Financial engineering. Derivatives can be constructed or combined to closely match specific portfolio requirements. For example, suppose a firm with a floating-rate loan needs to limit its exposure to sharp increases in the interest rate. The firm can purchase a derivative called an interest rate cap. This derivative pays the firm the difference between the floating rate of interest and a predetermined maximum called the cap rate whenever the floating rate exceeds the cap. Similarly, the lender can protect against a sharp decline in interest rates by purchasing an interest rate floor. This derivative pays the lender the difference between a predetermined floor rate and the floating rate whenever the floating rate falls below the floor. Another floating-rate borrower might want protection against any large change in the interest rate, either up or down. This borrower can construct an interest rate collar by purchasing a cap and selling a floor. In this case, the borrower's effective interest rate will lie between the floor and cap rates.[6] These three examples present fairly simple ways of using derivatives to meet specific portfolio requirements. Investors often construct far more complex derivatives positions to meet their special needs.

How do investors use derivatives?

The novel characteristics of derivatives make them useful in a variety of ways. Investors use derivative securities to hedge risk, to speculate on anticipated market movements, to adjust portfolios quickly and cheaply, and to arbitrage price discrepancies in financial markets. While investors could achieve most of these objectives using the underlying assets themselves, the special characteristics of derivatives make them more useful for these purposes.

Hedging and speculating. Derivatives are useful for hedging and speculating for three reasons. First, the values of derivatives are correlated with the values of their underlying assets. Second, it is easy to take a short position in derivatives. Finally, some derivatives have low transactions costs.[7] For example, an investor with a portfolio of bonds can hedge the value of that portfolio by shorting (selling) Treasury bond futures. An increase, say, in the general level of interest rates will reduce the value of the investor's bond portfolio. At the same time, though, the value of the investor's short position in Treasury bond futures will increase in response to the interest rate rise. The increase in the value of the futures position will hedge to some extent the decrease in the value of the investor's portfolio.[8]

Adjusting portfolios. The liquidity and low transactions costs of exchange-traded derivatives can make it cheaper to rapidly adjust a portfolio using derivatives rather than the underlying assets. In addition, the ability to create customized combinations of derivatives makes it possible to "fine-tune" portfolio adjustments in ways that might not be possible using only the underlying assets. For instance, a large institutional investor wishing to quickly increase its holdings of equities may find it impossible to buy large amounts of stock without driving up stock prices. This investor may be able to achieve the same result by buying stock index futures instead. The high liquidity of these futures makes their price less sensitive to large buy or sell orders. Later, stocks can be acquired slowly to avoid pushing up their prices, and the

position in stock index futures can simultaneously be closed out.

Arbitraging price discrepancies. Derivatives can be used to arbitrage price discrepancies in financial markets. Two types of arbitrage are important. First, investors can use derivatives to take advantage of differences in the cost of capital. For example, suppose a multinational firm needs to borrow dollars but could receive a preferential loan rate from a lender in Germany.[9] This firm might borrow German marks (DM) at the more favorable interest rate and convert the DM to dollars in the currency market. Then, to hedge the exchange rate risk of the future loan payments, the firm might enter into a dollar/DM currency swap (pay dollars/receive DM). In effect, the multinational firm borrows dollars at the lower German interest rate.

In the second type of arbitrage, market makers can use derivatives to take advantage of temporary discrepancies in asset prices. Because the value of a derivative security depends on the value of one or more underlying assets, investors can sometimes make riskless profits if the price of the derivative gets out of line with the prices of the underlying assets. Market makers are usually the only ones in a position to make arbitrage profits because market makers face lower transactions costs than other market participants. The readiness of market makers to pursue arbitrage opportunities guarantees that such price discrepancies are few and small.

WHY DO BANKS PARTICIPATE IN DERIVATIVES MARKETS?

Banks play two roles in the derivatives market. First, some money center banks are intermediaries in the OTC market, matching buyers and sellers of swaps and forward contracts. Second, many banks are end-users of derivatives, using them for the same purposes as other investors. The growth of bank participation is largely the result of the rapid growth in the use of OTC derivatives, which has generated demand for the intermediation services offered by money center banks.[10]

Banks' role as intermediaries

The OTC market in derivatives is supported by intermediaries who make a market in these derivatives. Important derivatives intermediaries include major banks and securities firms in the United States, United Kingdom, Japan, France, and Switzerland. End-users of derivatives turn to intermediaries in the OTC market when their needs cannot be completely met by the standardized contracts traded on exchanges (Board of Governors and others).

OTC intermediaries make a market in two ways. First, intermediaries act as brokers, matching parties with offsetting needs. More typically, though, intermediaries act as counterparties, taking the other side of the contracts with their customers. Without intermediaries, it would be difficult for firms, particularly nonfinancial firms, to find willing counterparties in a timely fashion. Thus, intermediaries increase the liquidity of the OTC derivatives market and, thereby, make OTC derivatives more useful to end-users.

Intermediation activities are a source of revenue for banks. This revenue takes three forms: transactions fees, bid-offer spreads, and trading profits. Banks sometimes charge end-users transactions fees for executing trades. More commonly, banks charge implicit fees by inserting a spread between their bid and offer quotes. For example, if a bank is acting as a broker and matching two end-users, the bank may arrange the trade so the seller of the contract receives slightly less than the amount paid by the buyer. This difference is the bid-offer spread. Similarly, when a bank acts as counterparty, it

may offer to pay somewhat less and ask to receive somewhat more than end-users pay and receive. Over a series of trades, these differences provide income to the bank.

Banks can also profit from their trading positions when there are discrepancies in asset prices. In their activities as market makers, banks acquire detailed information about asset prices and build up sometimes sizable asset positions. When a discrepancy arises, banks often recognize it quickly and can act to profit from it. Occasionally a bank can make riskless arbitrage profits when essentially the same asset is trading at different prices.[11] More commonly, banks can attempt to profit from spread trading, that is, from taking positions in assets whose relative spread has deviated from its traditional level. Unlike pure arbitrage, spread trading involves risk, but market makers can sometimes earn profits without exposing themselves to excessive risk.

Another advantage to banks of making a market in OTC derivatives is the opportunity it provides to strengthen relationships with their corporate customers. If banks did not participate as market makers, these customers might turn to other intermediaries for these services. These other intermediaries compete with banks in arranging financing for corporations. Thus, by acting as OTC intermediaries, banks can handle a wider range of corporations' financing needs and may also reduce the interaction between banks' corporate customers and banks' competitors.

Banks' role as end-users

Banks are also end-users in the derivatives markets. Banks' market-making activities expose them to financial market risks that they may wish to hedge with derivatives. Banks' traditional activities expose them to financial market risks as well.

As was noted above, banks build up positions in derivatives as a consequence of their market-making activities. These positions leave the banks exposed to financial market risks. To hedge against these risks, banks engage in offsetting trades, in the same way that other end-users trade in derivatives to hedge the risks associated with their portfolios and business activities. Sometimes banks will try to find an exact offset for their open position. For example, a bank that agrees as a market maker to enter into an interest rate swap may attempt as an end-user to enter into an offsetting swap. Alternatively, banks may buy or sell other assets, including other derivatives, that can hedge their open positions to some degree. Banks may use exchange-traded derivatives as well as OTC derivatives for hedging purposes, depending on which provide the best and cheapest hedges.

Banks' traditional activities can also leave them exposed to financial market risks, and these exposures lead banks to enter derivatives markets as end-users. For example, mortgage lending, particularly lending for fixed-rate mortgages, typically increases a bank's exposure to interest rate risk (Morris and Merfeld). A bank that increases its mortgage lending may choose to enter into an interest rate swap or to purchase interest rate futures to hedge some of its interest rate risk. Mortgage lending also exposes the bank to prepayment risk since mortgage borrowers have the option to prepay at any time (Becketti). As a result, a bank may choose to purchase interest-rate-based options to hedge some of the prepayment risk associated with mortgage lending.[12]

The growth in bank participation

Bank participation in the derivatives market has grown rapidly in recent years. Interest rate contracts account for most of the growth, both in the exchange-traded and OTC markets. Participation has been concentrated in a handful of the largest banks in the country.

One measure of bank participation is the notional value of bank holdings of derivatives. This measure grew almost sixfold from 1986 to 1992, from $1.4 trillion to $8.6 trillion.[13] In contrast, over the same six-year period total bank assets increased only 22 percent and commercial and industrial loans actually declined 16 percent.

Another measure of bank participation in derivatives markets is the replacement cost of banks' derivatives holdings. Unlike the notional value of banks' holdings—-which is used only for accounting purposes—-the replacement cost is an estimate of the real economic value of derivatives holdings. In particular, the replacement cost is an estimate of the loss the bank would suffer if the counterparties to the banks' derivatives positions failed to honor their contractual obligations. By the end of 1992, the replacement cost of banks' holdings of interest rate and foreign exchange derivatives reached $150 billion, an amount equal to 5 percent of banks' assets and two-thirds of banks' equity.

Reflecting general trends in derivatives markets, the fastest-growing component of bank's derivatives holdings has been OTC interest rate contracts (Remolona). From 1990 through 1992, the replacement cost of banks' interest rate contracts grew 84 percent, compared with 28 percent growth in the replacement cost of banks' foreign exchange contracts.[14] Banks' derivatives holdings have always been concentrated in such OTC derivatives as interest rate swaps and forward contracts for foreign exchange.

It is not surprising that banks have played such a large role in the growth of the OTC market, because credit risk is perhaps the most important risk of OTC derivatives. Banks' creditworthiness is well known to other investors, so money center banks are readily accepted as counterparties in OTC trades. In addition, gauging creditworthiness is banks' stock in trade. Banks already lend to many of the investors in OTC derivatives, thus they already know more than other market participants about the creditworthiness of these investors. And in cases where a bank is not already familiar with a particular investor, the bank possesses the expertise to make an informed judgment of creditworthiness.

While bank participation in derivatives markets has grown rapidly in recent years, it remains concentrated in a handful of large, money center banks (Board of Governors and others; Calla and Pomper). As of June 1992, bank holding companies with more than $10 billion in assets accounted for over 97 percent of the notional value of banks' derivatives holdings. And the ten bank holding companies with the largest holdings, as measured by replacement cost, accounted for 95 percent of the total holdings.

CAN BANKS MANAGE THE RISKS OF DERIVATIVES?

Banks participating in derivatives markets are exposed to credit risk, market risk, and operating risk (Table 1).[15] Some of these risks are the same as risks faced by banks in their traditional activities. As a result, banks have the means to manage these familiar risks. Other risks pose new challenges for bank management, and many banks may not be capable of managing these new risks. However, bank participation in derivatives markets is concentrated at a handful of large, money center banks that possess the sophistication and resources to manage both the familiar and the novel risks of derivatives. Thus at the current stage of market development, banks are able to safely manage the risks of derivatives.[16]

Credit risk

Credit risk in derivatives dealings includes the risk of default by a counterparty and the risk of changes in credit exposure.

Table 1

The Risks Derivatives Pose to Banks

Type of risk	Familiar or new
Credit risk	
Counterparty credit risk	Familiar
Potential exposure	New
Market risk	
Price risk	Familiar
Liquidity risk	Familiar
Settlement risk	
Ordinary settlement risk	Familiar
Anomalous settlement values	New
Cross-market disturbances	New
Operating risk	
Inadequate internal controls	
Risk of error or fraud	Familiar
Valuation risk	New
Legal risk	New
Regulatory risk	Familiar

Note: This table classifies the various risks derivatives pose to banks. Risks classified as familiar are similar in kind and scale to the risks banks face in their traditional lending and investing activities. Risks classified as new are either different in kind or greater in scale than the familiar risks. Of the risks classified as new, potential credit exposure, anomalous settlement values, and valuation risk are different in kind from the risks banks face in their traditional activities. Cross-market disturbances and legal risks are familiar to banks but these risks are more pronounced in banks' derivatives activities.

Counterparty credit risk. The risk of counterparty default is an important risk for OTC derivatives, the market segment in which banks are most heavily involved. OTC derivatives are bilateral contracts. If one counterparty defaults, the other counterparty is exposed to financial loss.[17] Thus, participants in the OTC derivatives market must carefully evaluate and monitor the creditworthiness of their counterparties.

This type of credit evaluation and monitoring is identical to the credit evaluation and monitoring banks undertake when making commercial loans. Moreover, many of a bank's derivatives counterparties are firms to whom it might reasonably make loans. As a consequence, counterparty credit risk does not present banks with a new type of risk to manage. Instead, it presents banks with the same type of risk they already manage, only in the context of investment activities rather than commercial lending. Indeed, banks sometimes require counterparties to post collateral against a derivatives position, just as

they sometimes require collateral of borrowers.

Potential exposure. While assessing the creditworthiness of counterparties is not new to banks, evaluating the potential exposure of derivatives positions is a new challenge. With a loan, the bank's maximum exposure to a default is the outstanding balance of the loan plus any legal costs of handling the default. In contrast, most derivatives contracts have no net value when they are initiated, but their value—and hence the bank's potential loss—may fluctuate significantly over the life of the contract. No money changes hands when a futures contract is exchanged or a swap is entered into, because the contract simply binds the parties to exchange in the future assets whose present values are equal.[18] As time passes, though, the value of a derivative changes in response to changes in financial market conditions.

Banks have experimented with ways to reduce potential increases in credit exposure. In addition to requiring collateral, banks sometimes require interim settlement of the current market value of a position. Or banks may require early settlement of an entire derivatives position if its market value exceeds a predetermined threshold. One approach that has attracted the interest both of banks and regulators is the use of netting agreements. Such agreements stipulate that all of a bank's derivatives contracts with a counterparty are closed out in the event the counterparty defaults on any of them (Bank for International Settlements, 1989, 1990; Group of Thirty). Netting agreements essentially use the contracts whose value has moved in favor of the defaulter as collateral against the contracts whose value has moved against the defaulter. The practice of netting has increased in the United States since the passage of the FDIC Improvement Act (FDICIA), which provided legal validation of a broad range of netting contracts and gave the Federal Reserve Board the authority to further extend this coverage, where appropriate. The legal status of cross-country netting agreements is still unresolved, and this uncertainty has slowed the spread of netting.

Market risk

Market risk describes banks' exposure to price fluctuations, reductions in market liquidity, uncertainty over settlement, and vulnerability to cross-market disturbances.

Price risk. The simplest type to understand is price risk: the value of a derivatives position will almost certainly change over time. Price risk is familiar to banks, which are exposed to price risk in all of their investment activities.[19] Moreover, it is misleading to consider the price risk of derivatives alone, since derivatives are typically used to hedge a bank's other assets and liabilities. Even when hedges are imperfect, derivatives typically reduce a bank's overall price risk.

Liquidity risk. Banks also face liquidity risk since, from time to time, circumstances may temporarily reduce the liquidity of particular derivatives. This ordinary liquidity risk is familiar to banks, since many traditional bank investments are also prone to temporary bouts of relative illiquidity. Indeed, commercial loans are extremely illiquid.

Another type of liquidity risk is associated with extraordinary events, such as the disruption of the European Exchange Rate Mechanism (ERM) in September 1992. Such incidents can temporarily reduce liquidity in many markets at the same time. As a consequence, investors may be unable to execute derivatives strategies designed to protect their portfolios precisely at the moment that protection is most needed.[20]

Liquidity risk is a problem for all derivatives investors, but it is probably more of a concern to intermediaries because they must continually adjust their derivatives positions to remain hedged. The financial market disruptions of the last six or seven years give some idea of the

likely effects of liquidity risk. While many market participants suffered losses during these disruptions, very few participants were severely impaired and systemic collapses were avoided.[21]

Settlement risk. Derivatives investors also face settlement risk. One kind of settlement risk is common to all financial markets and thus is familiar to banks. This risk arises when one party pays out funds or delivers assets before receiving assets or payment from its counterparty. Technical problems with the payment system or the sudden, unanticipated failure of the counterparty expose the paying party to the risk of loss. This kind of settlement risk is more pronounced in cross-country transactions because markets in the countries involved may not be open at the same time.

Another kind of settlement risk is unique to derivatives markets and thus presents a new challenge to bank managements. Many derivatives contracts are settled on terms that depend on the prices of particular assets at settlement time. For example, the settlement value of some contracts is determined by the average value of LIBOR, the London Interbank Offer Rate, on the settlement date. Similarly, the settlement value of a Treasury bond futures contract depends on the price of the bond that is cheapest to deliver on the expiration date, as specified in the futures contract. These asset prices may move anomalously on settlement day, and thus may affect the settlement values of derivatives contracts.

Cross-market disturbances. Derivatives investors are also vulnerable to cross-market disturbances. Because the values of derivatives are based on the value of one or more underlying assets, disturbances in the markets for the underlying assets can disrupt the derivatives market. An extreme example is the stock market break of October 1987, where the breakdown in the stock market's trading mechanisms led to intermittent closures of the stock index futures market (U.S. Presidential Task Force on Market Mechanisms). A related problem arises when portfolio strategies require taking positions simultaneously in several derivatives (and perhaps some underlying assets as well). These "multi-legged" positions are particularly vulnerable to cross-market disturbances, since a disruption in any one of the markets involved may make it impossible to manage the position safely.[22]

Banks are exposed to cross-market disturbances in their other investment activities. The links between financial markets have grown tighter over time. Thus, a disruption in, say, the Japanese stock market is likely to have an impact on the market for U.S. Treasury bonds. Nonetheless, by their nature, banks' derivatives activities probably involve more exposure to the risk of cross-market disturbances than do banks' other investment activities.

Operating risk

Operating risk refers to risks associated with monitoring and controlling risk-taking by employees, ensuring accurate valuation of derivatives holdings, guaranteeing legal enforceability of contracts, and anticipating changes in regulation.

Inadequate internal controls. Banks are exposed to operating risk in all their activities. Many bank failures can be traced, at least in part, to inadequate internal controls. In these instances, either management failed to adequately supervise employees who exposed the banks to losses, or misguided management policies inadvertently guided the banks toward failure.

Participating in derivatives markets requires highly sophisticated and reliable internal controls. Losses can occur in many ways. And because derivatives can be complex, the potential for human error is high. Also, the complexity of derivatives makes it difficult for management

to monitor the employees responsible for derivatives trading and thus to guard against error or fraud. And since some derivatives positions can be highly volatile, the cost of mistakes can mount rapidly. As a result, management may need to monitor derivatives positions more frequently than it monitors other aspects of the portfolio.

While not all banks are capable of maintaining the high level of internal controls required of derivatives traders, only a small number of large, money center banks have significant derivatives activities. These banks are among the most sophisticated financial institutions in the world, and they clearly possess the expertise and resources to manage the risks associated with derivatives trading. Nonetheless, even these banks must constantly review and upgrade their internal controls to take account of the special characteristics of derivatives and the rapid evolution of derivatives markets.[23]

Valuation risk. One aspect of a bank's internal controls is the maintenance of accurate valuations of derivatives holdings. Because of their complexity, the values of some of these assets can be calculated only with the aid of mathematical models. While the development and refinement of these models have been one of the most active areas of academic research in recent decades, all such models are based on assumptions about underlying market conditions. In periods of unusual turmoil or volatility, these assumptions may not hold, and the models may give misleading valuations. The problem of accurate valuation is widely recognized as an important risk in derivatives markets, and investors and regulators devote significant resources to improving valuations.

Legal risk. Legal risk is an important type of operating risk in derivatives markets, largely because derivatives are relatively new and involve some features whose legal standing is yet to be tested. During the 1980s, for example, the London Borough of Hammersmith and Fulham entered into interest rate swaps on which it subsequently suffered large losses. In January 1991, however, the U.K. House of Lords ruled that the borough lacked the legal authority to enter into interest rate swaps and invalidated the contracts. The Hammersmith and Fulham default has been estimated to account for half of all losses due to default since the inception of swap activity (Group of Thirty). Uncertainty about the legal enforceability of netting agreements also exposes banks to similar risk.

Regulatory risk. Regulatory risk—the possibility that regulatory treatment of bank activities might change—is an important risk for all of a bank's operations. But again, this risk may be higher for derivatives because derivatives markets are relatively new and some aspects of their regulatory treatment are still evolving. For example, banks must consider whether the treatment of derivatives positions and of netting schemes in the calculation of a bank's capital adequacy might change as derivatives markets and institutional arrangements continue to develop. Industry standards for hedge accounting also may be refined in the future, and these changes may be reflected in new regulations. Nonetheless, in recent years important changes in capital standards, deposit insurance, and other fundamental aspects of banking demonstrate that regulatory risk is familiar to banks.

Summary. Many of the most important risks of derivatives are essentially the same as those banks already manage. Perhaps the most important risk of the OTC derivatives in which banks specialize is the credit risk that a counterparty will default. Banks' core skill is evaluating the creditworthiness of borrowers. The leading market risk of derivatives is price risk. Banks already face similar price risks in their other investments. Moreover, the price risk of derivatives alone overstates total risk, since derivatives are used to hedge other bank assets and activities. Derivatives trading requires strict internal controls to protect against human error or

fraud, but traditional lending and investment activities require similar controls.

Some risks associated with derivatives present new challenges to bank managements. Accurately valuing derivatives positions and estimating potential credit exposures require sophisticated mathematical models and highly skilled staff. The potential for periods of reduced liquidity, anomalies in settlement values, and cross-market disturbances complicate the prudent management of derivatives positions. And uncertainties about the legal and regulatory treatment of derivatives activities test the abilities of bank managements as well.

The novel risks of derivatives suggest that, for many banks, it may not be prudent to have substantial derivatives dealings. And, in fact, only a handful of the largest and most sophisticated money center banks have significant derivatives activities. These banks have the capital, human resources, and financial market experience to understand and safely manage these risks.

The potential for illiquidity, cross-market disturbances, and related problems raises concerns about the vulnerability of the banking system as a whole to the new risks of derivatives. The limited experience so far suggests that derivatives markets and participants have the ability to weather market crises without suffering undue losses and without endangering financial markets generally. Derivatives participants emerged from the market crises of October 1987 and 1989 and the exchange rate disturbances of September 1992 in relatively good financial shape. And large commercial and investment banks with significant derivatives holdings have failed without disrupting derivatives markets or setting off a chain reaction of other failures. These admittedly few tests of derivatives markets should not make banks or regulators complacent, but they do show that the worst fears of the critics of derivatives may be avoidable.

CAN REGULATORS EFFECTIVELY SUPERVISE BANKS' DERIVATIVES ACTIVITIES?

Banking authorities—-such as the Federal Reserve, the FDIC, and the Comptroller of the Currency—have responsibilities for regulating bank activities to maintain the safety and soundness of individual banks and of the banking system. The growth of bank participation in derivatives markets adds a new set of activities which the authorities must monitor. The novel aspects of derivatives, particularly the complicated mathematical models used for valuing derivatives and calculating potential credit exposure, raise concerns about the ability of regulators to effectively supervise the derivatives activities of banks.

Despite these novel aspects, regulators can effectively supervise banks' use of derivatives. Banking authorities have addressed the new features of derivatives by participating in studies of developments in derivatives markets and by augmenting the training of examination staff. Moreover, the traditional tools of bank supervision—-on-site bank examinations, financial reports prepared by banks, and discussions with market participants—are just as useful in monitoring derivatives activities as they are in monitoring traditional bank lending and investment activities.

The challenge posed by the apparent complexity of derivatives valuation may well be overstated. Even the most complicated derivatives are composed of individual building blocks—individual options and forwards—which are well understood, and the values of these complex derivatives literally are equal to the sums of the values of the individual pieces. In fact, the ability to express the value of a derivative in a mathematical formula can be regarded as evidence that valuing derivatives is less complicated than evaluating the quality of some traditional bank assets. For example, a

loan for a large, commercial real estate project may involve many subtle risks that cannot be reduced to a simple mathematical formula. Instead, a great deal of judgment is required. Assessing the quality of such a loan may be a greater challenge for bank examiners than calculating the value of derivatives.

There is another way in which the challenge faced by regulators may be overstated. Because derivatives are complex, only a few, highly sophisticated banks have substantial derivatives activities. The majority of banks have negligible derivatives holdings. As a consequence, relatively few bank examiners need to fully understand derivatives. Providing adequate training for this modest number of examiners is a manageable burden for regulators.

The traditional tools of bank supervision keep regulators well informed of developments in derivatives market and of banks' competence in managing the risks of derivatives. On-site bank examinations are the cornerstone of supervisory efforts to evaluate the risks of all banking activities, including participation in derivatives markets. During examinations, regulators review capital adequacy, asset quality, management systems for internal control, earnings, and liquidity. For newer activities, such as participation in derivatives, examinations may be the best source of information for banking authorities. During a full-scope, on-site examination, examiners have the opportunity to meet with bank management to discuss a bank's experience with and plans for participation in derivatives markets. In addition, examiners can assess the adequacy of internal controls and the competence of the bank's staff to carry out management's policies concerning derivatives. Banks that are troubled or that show evidence of exposure to high risk receive extra scrutiny and may be required to submit additional information on their activities and to take steps to reduce their risk exposure.

Commercial banks also file quarterly Call Reports that disclose certain information about their derivatives activities. Bank holding companies provide similar information for the consolidated holding company. These reports enable banking authorities to identify the major participants in the derivatives markets and to gauge the growth of this participation. These reports also help authorities identify shifts in the types of derivatives purchased by banks.

In addition to the formal activities of examining banks and perusing financial reports, banking authorities have regular informal meetings with banks, other market participants, and trade organizations. For example, the Federal Reserve open market and foreign exchange staffs in Washington and New York meet often with market participants to monitor market conditions. These meetings also serve to alert the Federal Reserve to new developments in financial markets.

To ensure that the various implications of financial market changes are fully understood, banking authorities sponsor and participate in research on these developments. In recent years, several studies of derivatives markets have been conducted under the auspices of the Bank for International Settlements (BIS). These studies have drawn on the experiences of banking authorities from most of the countries with active derivatives markets. Each of these banking authorities, including the Federal Reserve, also has conducted its own studies of derivatives activities. And many members of the staffs of these authorities are engaged in research on topics related to bank participation in derivatives markets.

CONCLUSION

The rapid growth of bank participation in derivatives markets has raised concerns about the riskiness of this activity. In particular, the role of banks as OTC intermediaries has placed banks in the fastest growing and most rapidly

evolving part of the derivatives market.

Derivatives are more complicated than such investments as Treasury securities. In addition, derivatives are relatively new assets, and many features of derivatives and of their market organization are still evolving. As a consequence, some observers have expressed concerns that banks may not be able to safely manage, and regulators may not be able to effectively supervise, bank participation in derivatives markets.

These concerns appear to be overstated. The novel characteristics of derivatives make them particularly useful for hedging risks already faced by banks and other market participants. Banks have a natural advantage as intermediaries in the market for OTC derivatives, because evaluating the creditworthiness of derivatives counterparts is the most important factor in managing the risk of OTC trading. And the traditional tools of bank supervision keep regulators well informed of banks' competence in managing the risks of their derivatives activities.

As with any new asset or activity, banks and regulators need to exercise greater-than-usual vigilance as they gain experience with derivatives and as derivatives markets continue to evolve. Additional controls and safeguards may turn out to be needed. And derivatives activities are likely to remain concentrated in the handful of large, money center banks which have the resources and experience to safely manage this new activity. But, as former Fed chairman Paul Volcker said in his foreword to the recent Group of Thirty study of global derivatives practices,

> ...derivatives by their nature do not introduce risks of a fundamentally different kind or of a greater scale than those already present in the financial markets. Hence, systemic risks are not appreciably aggravated, and supervisory concerns can be addressed within present regulatory structures and approaches.

ENDNOTES

[1] This broad definition includes not only such contracts as futures, options, and swaps, but such instruments as mortgage-backed securities as well. There is an important difference, however, between these types of contracts: futures, options, and swaps are designed to transfer price risks associated with fluctuations in asset values. In contrast, mortgage-backed securities and other, similar derivatives are designed to facilitate borrowing and lending for specific purposes. In keeping with other recent accounts of the derivatives market, this article restricts its attention to contracts which transfer price risks, that is, to futures, options, swaps, and related contracts.

[2] Futures contracts have standard delivery dates and trading units and are almost always exchange-traded contracts. Forward contracts are customized contracts that allow the parties to select any delivery dates and trading units they wish. Forward contracts are over-the-counter instruments.

[3] Technically, all derivatives can be classified as either forward contracts, options, or combinations of forward contracts and options. Swaps, for instance, can be regarded as a sequence of forward contracts. These simple building blocks are used to create more complex structures such as caps, collars, floors, swaptions, etc.

[4] The valuation of derivatives is one of the most heavily researched areas in finance. In addition to the value of the underlying asset, the value of a futures contract is affected by the interest rate and the time remaining to the delivery date. Option values are influenced by all these factors as well as by the volatility of the value of the underlying asset. Hull presents a formal analysis of derivatives valuation.

[5] Many derivatives promise to deliver the underlying asset in the future. However, most derivatives are settled by taking offsetting positions in the derivative security rather than by taking or making delivery of the underlying asset. As a consequence, there is no effective limit on the quantity of claims to the underlying asset that can be traded. Indeed, outstanding futures contracts often promise to deliver many multiples of the existing quantity of the underlying asset.

[6] By selling a floor, the borrower is forgoing the savings that would be realized if the interest rate fell below the floor rate. However, the borrower receives an initial payment from the buyer of the floor contract which can be used to offset the cost of the cap contract that protects the borrower against increases in the interest rate.

7 Because speculators deliberately assume additional market risk, some observers have expressed concerns that the actions of speculators might increase volatility in financial markets or might raise the level of credit risk in the market. In some circumstances, though, speculators may reduce volatility by providing an increased supply of counterparties and thus increasing the liquidity of certain contracts. And to help control credit risk, derivatives exchanges frequently require speculators to post higher margins than other investors.

8 The futures contract will not provide a perfect hedge unless the investor's portfolio is composed of precisely the same Treasury bonds the futures contract promises to deliver (Morris 1989a, 1989b).

9 There are several ways this situation might arise. For example, the German lender might be a supplier to the multinational and might offer a better-than-market loan rate as a way to strengthen the ties between the two companies.

10 The current state of bank participation in derivatives markets, both as intermediaries and as end-users, is examined in Board of Governors of the Federal Reserve System and others. Remolona analyzes the recent growth in financial derivatives markets and discusses bank activities in these markets as well. Parkinson and Spindt provide a useful overview of bank activities as of the end of 1985, just prior to most of the growth in derivatives activity.

11 It may seem unlikely that a financial asset could have two different prices at one time. However, some combinations of assets guarantee the same cash flows as an underlying asset. These combinations are called synthetic securities since combining (synthesizing) the component assets produces the same payoff as buying the underlying asset. Since the prices of each of the component assets are set in separate markets, the price of the synthetic security may sometimes fail to equal the price of the underlying asset. When this happens, intermediaries can earn arbitrage profits by simultaneously buying the cheaper version (synthetic or underlying) of the asset and selling the more expensive version. This arbitrage eventually eliminates the price discrepancy.

12 Since a bank's traditional activities create an exposure to financial market risks, the portfolio changes that result from market-making activities may actually reduce the bank's need to hedge. Consider again the example of a bank that makes fixed-rate mortgage loans funded by floating-rate deposits. When acting as an intermediary in the OTC derivatives market, this bank might become the floating-rate counterparty in a number of interest rate swaps. That is, the bank might agree to make floating-rate payments in exchange for receiving fixed interest payments. These swaps would tend to offset the bank's exposure to interest rate risk.

13 Data on banks' positions in derivatives come from the Consolidated Financial Statements for Bank Holding Companies (FR Y-9C) that bank holding companies file with the Federal Reserve. Data for interest rate swaps and foreign exchange futures and forwards are available from the second quarter of 1986, along with limited data on other off-balance-sheet items. More detailed information on derivatives positions is available starting in the third quarter of 1990. The Y-9C records notional values which greatly exceed the market values or replacement costs of the contracts. Nonetheless, the rate of growth in the notional values is an estimate of the rate of growth in the market values. The notional values reported in the text include foreign exchange contracts with an original maturity of 14 days or less. These short-term contracts totaled between $300 billion and $600 billion at the end of 1992. The replacement cost figures reported below exclude these short-term contracts. Excluding short-term foreign exchange contracts from the notional value figures would not change the impression that banks' derivatives holdings grew very rapidly from 1986 through 1992.

14 The replacement cost of banks' foreign exchange contracts is almost twice the size of the replacement cost of its interest rate contracts—$98 billion in foreign exchange contracts at the end of 1992 compared with $52 billion in interest rate contracts—but, as the text notes, interest rate contracts are growing more rapidly. Commodity and equity contracts, on the other hand, comprise a much smaller fraction of banks' derivatives holdings (Board of Governors and others).

15 There are many ways to classify financial market risks. The report prepared by the banking agencies (Board of Governors and others) distinguishes credit risk, market risk, operating risk, settlement risk, market liquidity risk, legal risk, and aggregate or interconnection risk. The report of the Group of Thirty's Global Derivatives Study Group combines settlement risk with credit risk and liquidity risk with market risk. This article follows the report of the Bank of England's internal working group on derivatives by allocating these various risks to just three categories: credit risk, market risk, and operating risk.

16 This section and the next one draw heavily on Bank of England and Board of Governors and others.

17 Only counterparties with positively valued contracts are exposed to credit risk. Many derivatives contracts have zero net value at their inception. For example, swaps are typically initiated so the values of both sides of the swap are equal in value. For such contracts, there is no initial credit risk. Over time, though, market developments change the values of each side of the contract so one counterparty is a net loser while the other is a net gainer. Only the loser has an incentive to default (creditors do not default), and only the winner is exposed to credit risk.

[18] In contrast to forward agreements, options have positive value at inception which accounts for the premium the buyer pays for them. Thus, a bank that purchases options is immediately exposed to credit risk. The problem of assessing changes in potential credit exposure is much the same, however, for options as for forward agreements.

[19] Derivatives are sometimes very complex, making it more difficult to evaluate their price risk than the price risk of, say, Treasury securities. This valuation risk is discussed below in the context of operational risk.

[20] A well-known example of this phenomenon is the breakdown of the portfolio insurance strategy during the stock market break of October 1987.

[21] Some caveats should be noted here. During the market break of October 1987, in particular, markets failed to function for significant amounts of time. Moreover, it is difficult to assess how bad conditions might have become in the absence of timely intervention by regulatory agencies. While systemic collapses were averted, it is impossible to say how narrowly they were averted. For a detailed account of events during the October 1987 market break, the most severe disruption in recent years, see the report of the Brady Commission (U.S. Presidential Task Force on Market Mechanisms).

[22] A risk related to cross-market disturbances is systemic risk, the possibility that a disruption by any participant or group of participants causes widespread difficulties throughout financial markets. To date, events that might have triggered such difficulties have successfully been controlled, but not without considerable efforts on the part of regulators and market participants (Board of Governors and others).

[23] The Global Derivatives Study of the Group of Thirty surveys current industry practices and recommends minimum operational and management standards that market participants should meet.

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