The Federal Reserve Board

Remarks by Chairman Alan Greenspan

Financial derivatives

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By far the most significant event in finance during the past decade has been the extraordinary development and expansion of financial derivatives. This morning I should like to evaluate the scope of these markets, the nature of the risks they entail, and some of the difficulties we encounter in managing those risks.

At year-end, U.S. commercial banks, the leading players in global derivatives markets, reported outstanding derivatives contracts with a notional value of $33 trillion, a measure that has been growing at a compound annual rate of around 20 percent since 1990.

Of the $33 trillion outstanding at year-end, only $4 trillion were exchange-traded derivatives; the remainder were off-exchange or over-the-counter (OTC) derivatives. The greater use of OTC derivatives doubtless reflects the attractiveness of customized over standardized products. But regulation is also a factor; the largest banks, in particular, seem to regard the regulation of exchange-traded derivatives, especially in the United States, as creating more burdens than benefits. As I have noted previously, the fact that the OTC markets function quite effectively without the benefits of the Commodity Exchange Act provides a strong argument for development of a less burdensome regime for exchange-traded financial derivatives.

Of course, notional values are not meaningful measures of the risks associated with derivatives. Indeed, it makes no sense to talk about the market risk of derivatives; such risk can be measured meaningfully only on an overall portfolio basis, taking into account both derivatives and cash market positions, and the offsets between them.

Clearly, the degree of counterparty credit risk on derivatives depends critically on the extent to which netting and margining procedures are employed to mitigate the risks. In the case of exchange-traded contracts, of course, daily variation settlements by clearing houses strictly limit, if not totally eliminate, such counterparty risks.

In the case of OTC derivatives, counterparty credit exposures are far larger, though still a very small fraction of the notional amounts. On a loan equivalent basis, a reasonably good measure of such credit exposures, U.S. banks' counterparty exposures on such contracts are estimated to have totaled about $325 billion last December. This amounted to less than 6 percent of banks' total assets. Still, these credit exposures have been growing rapidly, more

or less in line with the growth of the notional amounts.

The leading role played by U.S. commercial and investment banks in the global OTC derivatives markets is documented in a Bank of International Settlements survey for last June. This survey estimated that size of the global OTC market at an aggregate notional value of $70 trillion, a figure that doubtless is closer to $80 trillion today. Once allowance is made for the double-counting of transactions between dealers, U.S. commercial banks' share of this global market was about 25 percent, and U.S. investment banks accounted for another 15 percent. While U.S. firms' 40 percent share exceeded that of dealers from any other country, the OTC markets are truly global markets, with significant market shares held by dealers in Canada, France, Germany, Japan, Switzerland, and the United Kingdom.

Despite the world financial trauma of the past eighteen months, there is as yet no evidence of an overall slowdown in the pre-crisis derivative growth rates, either on or off exchanges. Indeed, the notional value of derivatives contracts outstanding at U.S. commercial banks grew more than 30 percent last year, the most rapid annual growth since 1994. Although episodes of extreme volatility have produced declines in the most highly leveraged contracts, the growth of the more "plain vanilla" products has continued apace or even accelerated.

The reason that growth has continued despite adversity, or perhaps because of it, is that these new financial instruments are an increasingly important vehicle for unbundling risks. These instruments enhance the ability to differentiate risk and allocate it to those investors most able and willing to take it. This unbundling improves the ability of the market to engender a set of product and asset prices far more calibrated to the value preferences of consumers than was possible before derivative markets were developed. The product and asset price signals enable entrepreneurs to finely allocate real capital facilities to produce those goods and services most valued by consumers, a process that has undoubtedly improved national productivity growth and standards of living.

Nonbank, as well as bank, users of these new financial instruments have increasingly embraced them as an integral part of their capital risk allocation and profit maximization. It should come as no surprise that the profitability of derivative products has been a major factor in the dramatic rise in large banks' noninterest earnings and doubtless is a factor in the significant gain in the overall finance industry's share of American corporate output during the past decade. In short, the value added of derivatives themselves derives from their ability to enhance the process of wealth creation.

While the value of risk unbundling has been known for decades, the ability to create sophisticated instruments that could be effective in a dynamic market had to await the last decade's development of computer and telecommunications technologies. The ability to create and employ sophisticated financial products also galvanized the academic community to develop increasingly complex models of risk management. While recent history suggests that such models are useful, they are doubtless in need of much improvement--an issue to which I will return shortly.

Yet beneath all of the evidence of the value of derivatives to a market economy, there remains a deep seated fear that while individual risks seem clearly to have been reduced through derivative facilitated diversification, systemic risk has become enlarged, as a consequence. Without question, derivatives facilitate the implementation of leveraged trading strategies, though the very technology that has made derivatives feasible has also improved the ability to leverage without derivatives. Nonetheless, the possibility of increased systemic risk does appear to be an issue that requires fuller understanding.

We should point out, first, the obvious. Overall, derivatives are mainly a zero sum game: one counterparty's market loss is the other counterparty's market gain. Counterparty credit exposures on OTC derivatives are a different issue and the source of much of the systemic concerns. Such losses rose to record levels in the third quarter of 1998. Nonetheless, the rate of loss remained well below that on banks' loan portfolios. Moreover, the counterparty credit losses in the third quarter can be traced primarily to the extraordinary events in Russia, which produced many defaults on ruble forward contracts. In the fourth quarter such losses dropped sharply, albeit not to the very low pre-crisis rate.

The bulk of the losses reported by the major derivative houses for the financially turbulent third quarter of last year reflected declines in the market values of their underlying trading positions, especially in equities, commodities, and emerging market debt. Derivative instruments were bystanders. They may well have intensified the losses in underlying markets, but they were scarcely the major players.

Yet, through the past decades' phenomenal growth of the derivative market, there has not been a significant downturn in the economy overall that has tested the resilience of derivative markets. (I operate on the premise that neither human nature nor the business cycle has been rendered obsolete.)

While nothing short of a major economic adjustment is likely to test the underlying robustness of the derivative markets, there are reasons to believe that there are some fundamental strengths in these markets. First, despite the growing use of more exotic over-the-counter instruments, the vast majority of trades are relatively straightforward interest rate and currency swaps. The market risk on such swaps is presumably less daunting to individual counterparties than their underlying exposures, or presumably the swaps would never have been initiated. Moreover, the credit risks are increasingly subject to comprehensive netting and margin requirements that, although they do not fully remove the risk, significantly ameliorate it. And so far as banks are concerned, capital requirements are applied to such risks as they are to loans that create credit risks quite similar to those of derivatives.

Hence, although one may harbor concerns about the overall capital adequacy of banks and their degree of leverage, there is little to distinguish such concerns between risk adjusted on- and off-balance sheet claims.

The one area of risk that needs more thought is so-called potential future exposure. At any particular point in time only a small fraction of the notional value of derivative contracts are

in the money--that is, have a positive market value. Because prices will doubtless change in the future, those contracts with negative or even positive values have the potential of larger positive values and, hence, a potential credit loss on default.

That future potential for loss upon counterparty default will differ by the nature of the contract. For purposes of supervisory risk-based capital requirements, potential future exposure (over and above the current market value of derivatives, if positive) is currently estimated by separating derivatives into categories based on the underlying instrument (interest rate, exchange rate, commodity, equity, etc.) and the remaining maturity. The capital requirement is then derived by applying fixed factors to each category that reflect differences in the price volatilities of the instruments and the structure of the contracts. Interest rate swaps (70 percent of the notional value of OTC derivatives) have limited long-term loss potential, primarily because the contracts do not provide for an exchange of principal and the exposure is effectively amortized as interest payments are exchanged over the life of the contract. Foreign exchange, commodity, and equity derivatives, of course, entail far greater exposures, either because principal amounts are exchanged or because the underlying's price is more volatile.

This approach to regulatory capital requirements is not altogether satisfactory. The most sophisticated derivative dealers parse their derivatives book in more detail. And certainly a single point estimate cannot capture the range of losses that might reasonably be experienced. Hence, in evaluating derivatives risk, far more stress testing of the lower probability outcomes is a necessity. Even a one in 500 occurrence does happen once every 500 times, and if that occurrence could threaten the franchise value of the derivatives counterparty it is an important concern for risk aversion.

But we have to be careful of how we view these ostensibly low probability events. They are low probability only if we presume that the reality from which these events derive is best represented by a single bell-shaped probability distribution, be it a normal distribution or even a fat-tailed one.

Modern quantitative approaches to risk measurement and risk management take as their starting point historical experience with market price fluctuations, which is statistically summarized in probability distributions. We live in what is mostly a stable economic system in which market imbalances give rise to continuous and inevitable moves toward equilibrium resolutions. However, the violence of the responses to what seemed to be relatively mild imbalances in southeast Asia in 1997 and throughout the global economy in August and September of 1998 have raised the possibility of a discontinuous adjustment process.

Almost all the time investors adopt strategies that seek profit only in a relatively long- term context, fostering the propensity for convergence toward equilibrium that ordinarily characterizes financial markets. But from time to time (and quite possibly with increasing frequency) the resulting propensity toward convergent equilibrium has given way as investors suffer an abrupt collapse of comprehension of, and confidence in, future economic events. Risk aversion accordingly rises dramatically and deliberative trading strategies are

replaced by rising fear-induced disengagement. Yield spreads on relatively risky assets widen dramatically. In the more extreme manifestation, the inability to differentiate among degrees of risk drives trading strategies to ever more liquid instruments. Strategies become so tentative that traders want the capacity to reverse decisions at minimum cost. As a consequence, even among riskless assets, illiquidity premiums rise dramatically as investors seek the heavily traded "on-the-run" issues.

History tells us that sharp reversals in confidence happen abruptly, most often with little advance notice. They are self-reinforcing processes that can compress into a very short time period. Panic market reactions are characterized by a dramatic shift to maximize short term value, and are an extension of human behavior that manifests itself in all forms of human interaction--a set of responses that does not seem to have changed over the generations. I defy anyone to distinguish a speculative price pattern for 1999 from one for 1899 if the charts specify neither the dates nor the levels of the prices.

If this paradigm turns out to be the appropriate representation of the way our economy and our financial markets will work in the future, it has significant implications for risk management. Probability distributions estimated largely, or exclusively, over cycles excluding periods of panic will underestimate the probability of extreme price movements because they fail to capture a secondary peak at the extreme negative tail that reflects the probability of occurrence of a panic. Furthermore, joint distributions estimated over panicless periods will underestimate the degree of correlation between asset returns during panics when fear and disengagement by investors results in simultaneous declines (or, in rare instances, increases) in values as investors no longer adequately differentiate among degrees of risk and liquidity. Consequently, the benefits of portfolio diversification will tend to be significantly overestimated by current models.

Such a view of the world would also have important implications for approaches to the prudential oversight of capital adequacy for banks and other financial institutions. Regulatory minimum capital requirements for banks' trading portfolios are now based on the banks' own internal risk measurement models. Furthermore, regulators are exploring the potential for using an internal models approach to credit risk in the banking book.

Some may now argue that the periodic emergence of financial panics implies a need to abandon models-based approaches to regulatory capital and to return to traditional approaches based on regulatory risk measurement schemes. In my view, however, this would be a major mistake. Regulatory risk measurement schemes are simpler and much less accurate than banks' risk measurement models. Consequently, they provide banks with the motive and the opportunity to engage in regulatory arbitrage that seriously undermines the regulatory standard and frustrates the underlying safety and soundness objective. Specifically, they induce banks to reduce holdings of assets where risks and regulatory capital are overestimated by regulators and increase holdings of assets where risks are underestimated by regulators.

It would be far better to provide incentives for banks to enhance their risk modeling procedures by taking account of the potential existence and implications of discontinuous

episodes. Scenario analysis can highlight vulnerabilities to the kind of flights to quality and flights to liquidity that seem increasingly frequent. Stress testing of correlation assumptions can reveal the disappearance of apparent diversification benefits in such scenarios.

Stress testing requirements already are part of the internal models approach to capital requirements for market risks in bank trading accounts. Stress testing of estimates of counterparty credit risks should also be required. The logic is the same as for market risk. The factors that are used to determine supervisory capital requirements for counterparty credit exposures are based on statistical analyses of non-panic periods. Moreover, during panic periods the usual assumption that potential future exposures are uncorrelated with default probabilities becomes invalid. For example, the collapse of emerging market currencies can greatly increase the probability of defaults by residents of those countries at the same time that exposures on swaps in which those residents are obligated to pay foreign currency are increasing dramatically.

Supervisors should avoid any temptation to increase the supervisory factors for potential future exposure to address these crisis scenarios, which have vastly different implications for different combinations of contracts and counterparties. But they can and should review the requirements relating to the scenarios to be simulated by the bank and the incorporation of stress test results into the policies and limits set by the bank's management and board of directors.

As we approach the twenty-first century, both banks and nonbanks will need to continually reassess whether their risk management practices have kept pace with their own evolving activities and with changes in financial market dynamics and readjust accordingly. Should they succeed I am quite confident that market participants will continue to increase their reliance on derivatives to unbundle risks and thereby enhance the process of wealth creation.

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