CHAPTER IV OVER-THE-COUNTER DERIVATIVES MARKETS

The virulence of the 1998 turbulence in the mature financial markets took market participants and authorities by surprise, and some have acknowledged that they do not fully understand the rapidly changing structure and dynamics of global financial markets.[1] As last year's *International Capital Markets* report analyzed, a substantial buildup in derivatives credit exposures and leverage contributed importantly to the turbulence. This substantial leverage—LTCM accumulated $1.2 trillion in notional positions on equity of $5 billion—was possible primarily because of the existence of large, liquid OTC derivatives markets. The rapid growth, development, and widespread use of OTC derivatives markets has accompanied the modernization of commercial and investment banking and the globalization of finance, driven by recent advances in information and computer technologies, and has contributed significantly and positively to the effectiveness of global finance and, in particular, of international financial markets. Much has been written about derivatives as financial instruments and about the role of highly leveraged institutions. By contrast, less has been written about the markets for OTC derivatives per se, and the heavy reliance on them by the small group of internationally active financial institutions. This chapter attempts to fill part of this gap.

Derivatives bestow considerable benefits by allowing financial risks to be more precisely tailored to risk preferences and tolerances, and they contribute to more complete financial markets, improve market liquidity, and increase the capacity of the financial system to bear risk and intermediate capital. Derivatives instruments, the structures for trading and risk managing them, and the infrastructures for ensuring their smooth functioning play a central role in the smooth functioning of the major financial and capital markets. These instruments and markets have been designed and developed by the internationally active financial institutions that presently derive a large share of their earnings from these activities. These are the same financial institutions that make up the core of the international financial system and have access to financial safety nets.

While derivatives instruments and markets have improved the effectiveness of intermediation and finance generally, and are likely to continue to do so, as crises in the 1990s demonstrated, OTC derivatives activities can contribute to the buildup of vulnerabilities and adverse market dynamics in some circumstances. The severity of repeated episodes of turbulence, and in particular the contours of the market dynamics in the aftermath of the near-collapse of LTCM, suggest that OTC derivatives activities are capable of, producing instability, in some cases akin to a modern form of traditional bank runs. Because of their importance in global finance, it is important to understand more fully the potential capacity for the OTC derivatives activities of internationally active financial institutions to contribute to international systemic financial problems.

Taking the benefits and efficiency-enhancing characteristics of OTC derivatives as a given, this chapter begins with a brief discussion of modern financial intermediation. It argues that internationally active financial institutions have exposed themselves to additional sources of instability because of their large and dynamic exposures to the counterparty (credit) risks embodied in their OTC derivatives activities. Before identifying these sources of instability, the chapter compares OTC derivatives with exchange-traded derivatives, including their respective trading

[1]See the Glossary at the end of this chapter for definitions of special terms.

environments. This comparison reveals significant differences in how private and collective risks are managed and suggests that OTC activity may be more conducive to producing systemic risks. The chapter then argues that features of OTC instruments, modern financial institutions, and the underlying OTC infrastructures can pose risks to stability, separately and jointly, that in some circumstances create the tendency toward instability in global financial markets. It is easier to identify the sources of instability in OTC derivatives markets than it is to find remedies, which can only be pragmatically formulated and implemented by private and official practitioners in these markets. Nevertheless, in a concluding section the chapter points to both private efforts (more effective market discipline, risk management, and disclosure) and public efforts (strengthen incentives for market discipline, remove legal and regulatory uncertainties, and improve effectiveness of OTC market surveillance) that seem to be required if the risks of instability are to be contained in modern OTC derivatives markets.

Modern Banking and OTC Derivatives Markets

During the past two decades, the large internationally active financial institutions have transformed the business of finance dramatically. In doing so, they have improved the ability to manage, price, trade, and intermediate capital worldwide. Many of these benefits have come from the development, broadening, and deepening of, and greater reliance on, OTC derivatives activities. Although modern financial institutions still derive most of their earnings from intermediating, pricing, and managing credit risk, they are doing increasingly more of it off balance sheet, and in less transparent and potentially riskier ways. This transformation has accelerated during the 1990s.

Traditional banking involves extending loans on borrowed funds (deposits) of different maturities. Each side of this ledger has different financial risks. A simple loan is for a fixed sum, term, and interest rate; in return the bank is promised a known schedule of fixed payments. The risk in lending, of course, is that the borrower may become unable or unwilling to make each fixed payment on schedule. This is credit (or counterparty) risk, comprising both the risk of default (missing one or all payments) and the expected loss-given default (that less than is promised is paid). Loans are funded by deposits with much shorter maturities than most bank loans, which imparts liquidity risk. The basic business of banking is to manage these two sets of cash flows, each having a different, stochastic structure. As the history of bank runs and failures indicates, managing these cash flows is inherently risky and banking is prone to instability.[2]

This tendency toward instability does not seem to have diminished in the 1990s, and may have increased. In modern finance, financial institutions' off-balance-sheet business entails extensions of credit. For example, a simple swap transaction is a two-way credit instrument in which each counterparty promises to make a schedule of payments over the life of the contract. Each counterparty is both a creditor and debtor and, as in traditional banking, the modern financial institution has to manage the cash inflows (the creditor position) and outflows (the debtor position) associated with the derivatives contract. But there are important differences. First, the embedded credit risk is considerably more complicated and less predictable than the credit risk in a simple loan, because the credit exposures associated with derivatives are time varying and depend on the prices of underlying assets. Traditional bank lending is largely insulated from market risk, because banks carry loans on the balance sheet at book value, which means that they may not recognize and need not respond to market shocks. Nevertheless, market developments can contribute to unrecognized losses that can accumulate over time. By contrast, OTC credit exposures are subject to volatile market risk and are, as a matter of

[2]See Bryant (1980), Diamond and Dybvig (1983), and Kindleberger (1989).

course, marked to market every day. This creates highly variable profit-and-loss performance, but it imparts market discipline and also avoids undetected accumulations of losses. Day-to-day shifts in the constellation of asset prices can have a considerable impact on credit risk exposures—both the exposures borne by any particular financial institution and the distribution and concentration of such exposures throughout the international financial system.

Second, the liquidity dynamics of modern finance are considerably more complex than those of deposit markets. Deposit flows have a degree of regularity associated with the flow of underlying business. By contrast, flows associated with OTC derivatives and liquidity conditions in these markets, and in related markets, can be highly irregular and difficult to predict, even for the most technically advanced dealers with state-of-the-art risk management systems. Overall, the stochastic processes that govern the cash flows associated with OTC derivatives are inherently more difficult to understand, and seem to be more unstable during periods of extreme volatility in underlying asset prices.

Thus, in addition to assessing and managing the risk of default and the expected loss-given default, the modern financial institution has to assess the potential change in the value of the credit extended and form expectations about the future path of underlying asset prices. This, in turn, requires an understanding of the underlying asset markets and establishes a link between derivatives and underlying asset markets.

The unpredictable, and at times turbulent, nature of OTC derivatives markets would merit little concern if OTC derivatives were an insignificant part of the world of global finance. They are not, and indeed they are increasingly central to global finance. OTC derivatives markets are large, at end-1999 comprising $88 trillion in notional principal, the reference amount for payments, and nearly $3 trillion in (off-balance-sheet) credit exposures (see Tables 2.7 and 2.8 in Chapter II). The markets are composed of systemically important financial institutions (Table 4.1), and together the instruments and markets interlink the array of global financial markets through a variety of channels.[3]

In the past two decades, the major internationally active financial institutions have significantly increased the share of their earnings from derivatives activities, including from trading fees and proprietary trading profits. These institutions manage portfolios of derivatives involving tens of thousand of positions, and daily aggregate global turnover now stands at roughly $1 trillion. The market can be seen as an informal network of bilateral counterparty relationships and dynamic, time-varying credit exposures whose size and distribution are intimately tied to important asset markets. Because each derivatives portfolio is composed of positions in a wide variety of markets, the network of credit exposures is inherently complex and difficult to manage. During periods in which financial market conditions stay within historical norms, credit exposures exhibit a predictable level of volatility, and risk management systems can within a tolerable range of uncertainty assess the riskiness of exposures. Risk management systems guide the rebalancing of the large OTC derivatives portfolios, which in normal periods can enhance the efficient allocation of risks among firms, but which can also be a source of trading and price variability—especially in times of financial stress—that feeds back into the stochastic nature of the cash flows.

Expansions and contractions in the level of OTC derivatives activities are a normal part of modern finance and typically occur in a nondisruptive manner, if not smoothly, even when there is isolated turbulence in one underlying market. The potential for excessively rapid contractions and instability seems to emerge when credit exposures in OTC activities rise to levels that create hypersensitivity to sudden unanticipated changes in market conditions (such as interest rate spreads) and new information. The

[3]See the discussion of spillovers and contagion in IMF (1998a).

Table 4.1. Top 20 Derivatives Dealers in 2000 and Their Corresponding Ranks in 1999

	Rank		Members of Exchanges[3]					
Derivatives Dealers	2000	1999	CME	LIFFE	EUREX	HKFE	TSE	TIFFE
Citigroup	1	1	x	x	x	x	x	
Goldman Sachs & Co.	2	2	x	x	x	x	x	
Deutsche Bank[1]	3	6	x	x	x	x	x	
Morgan Stanley Dean Witter	4	4	x	x	x	x	x	
Warburg Dillon Read	5	7	x	x	x	x	x	
Merrill Lynch & Co.	6	5	x	x	x	x	x	
J.P. Morgan	7	3	x	x	x	x	x	
Chase Manhattan Corp.	8	8	x	x	x			x
Credit Suisse First Boston	9	9	x	x	x	x	x	
Bank of America	10	11	x	x	x			x
NatWest Group	11	n.a.		x	x			x
Lehman Brothers	12	12	x	x	x	x	x	
Hong Kong and Shanghai Banking Corp.	13	16	x	x	x	x	x	x
Société Générale	14	13		x	x		x	
American International Group	15	19	x					
Barclays Capital	16	14	x	x	x	x	x	x
Dresdner Kleinwort Benson	17	n.a.	x	x	x		x	
BNP-Paribas[2]	18	18	x	x	x	x	x	
ABN Amro	19	17	x	x	x	x	x	
Commerzbank	20	n.a.	x	x	x		x	

Source: Clow (2000), pp. 121–25.
[1]Includes BT Alex. Brown for 2000.
[2]Ranking of Banque Paribas for 1999.
[3]Chicago Mercantile Exchange (CME); London International Financial Futures and Options Exchange (LIFFE); European Derivatives Market (EUREX); Hong Kong Futures Exchange (HKFE); Tokyo Stock Exchange (TSE); and Tokyo International Financial Futures Exchange (TIFFE).

creditor and debtor relationships implicit in OTC derivatives transactions between the internationally active financial institutions can create situations in which the possibility of isolated defaults can threaten the access to liquidity of key market participants—similar to a traditional bank run. This can significantly alter perceptions of market conditions, and particularly perceptions of the riskiness and potential size of OTC derivatives credit exposures. The rapid unwinding of positions, as all counterparties run for liquidity, is characterized by creditors demanding payment, selling collateral, and putting on hedges, while debtors draw down capital and liquidate other assets. Until OTC derivatives exposures contract to a sustainable level, markets can remain distressed and give rise to systemic problems. This is what happened in 1998: after it became known that LTCM might default, some dealers were concerned that their dealer counterparties were heavily exposed to LTCM. The induced changes in market conditions quickly created a run for liquidity.

Greater asset price volatility related to the rebalancing of portfolios may be a reasonable price to pay for the efficiency gains from global finance. However, in the 1990s, OTC derivatives activities have sometimes exhibited an unusual volatility, and have added to the historical experience of what volatility can mean. For example, in the 1990s, there were repeated periods of volatility and stress in different asset markets (ERM crises; bond market turbulence in 1994 and 1996; Mexican, Asian, and Russian crises; LTCM; Brazil) as market participants searched for higher rates of return in the world's major bond, equity, foreign exchange, and derivatives markets. Some of these episodes suggest that the structure of market dynamics has been adversely affected by financial innovations and

has become more unpredictable, if not unstable.[4]

Examples of extreme market volatility include movements in the yen-dollar rate in both 1995 and 1998. In both cases the yen-dollar exchange rate exhibited what might be characterized as extreme price dynamics—beyond what changes in fundamentals would suggest was appropriate—in what was, and is, one of the deepest and most liquid markets. The extreme nature of the price dynamics resulted in part from hedging positions involving the use of OTC derivatives contracts called knockout options (see Box 4.1). These OTC options are designed to insure against relatively small changes in an underlying asset price. Yet once a certain threshold level of the yen-dollar rate was reached, the bunching of these OTC options drove the yen-dollar rate to extraordinary levels in a very short period of time—an event that the OTC options were not designed to insure against.

Such episodes of rapid and severe dynamics can also pose risks to systemic stability. In particular, the turbulence surrounding the near-collapse of LTCM in the autumn of 1998 posed the risk of systemic consequences for the international financial system, and seemed to have created consequences for real economic activity (see Box 4.2). This risk was real enough that major central banks reduced interest rates to restore risk taking to a level supportive of more normal levels of financial intermediation and continued economic growth. LTCM's trading books were so complicated and its positions so large that the world's top derivatives traders and risk managers from three major derivatives houses could not determine how to unwind LTCM's derivatives books rapidly in an orderly fashion without retaining LTCM staff to assist in liquidating the large and complex portfolio of positions.

Both private market participants and those responsible for banking supervision and official market surveillance are learning to adapt to the fast pace of innovation and structural change. This challenging learning process has been made more difficult because OTC derivatives activities may have changed the nature of systemic risk in ways that are not yet fully understood.[5] The heavy reliance on OTC derivatives appears to have created the possibility of systemic financial events that fall outside of the more formal clearinghouse structures and official real-time gross-payment settlement systems that are designed to contain and prevent such problems. There is the concern that heavy reliance on new and even more innovative financial techniques, and the possibility that they may create volatile and extreme dynamics, could yet produce even greater turbulence with consequences for real economic activity—perhaps with consequences reaching the proportions of real economic losses typically associated with financial panics and banking crises.

In sum, the internationally active financial institutions have increasingly nurtured the ability to profit from OTC derivatives activities and they now benefit significantly from them. As a result, OTC derivatives activities play a central role in modern financial intermediation. This raises the concern that the instabilities associated with modern finance and OTC derivatives markets could give rise to systemic problems that potentially could affect the international financial system.

Exchange Versus OTC Derivatives Markets

Before discussing the features of OTC derivatives markets that can give rise to instability, it is useful to examine key differences between exchange-traded and OTC derivatives, including the different trading and risk management environments. This clarifies why OTC derivatives activities are both efficiency enhancing and prone to problems. Compared to exchange-traded derivatives, OTC derivatives markets have the following features: (1) management of counterparty

[4]For emerging market examples, see Chapter VI.
[5]See Greenspan (1998) and Tietmeyer (1999).

Box 4.1. The Role of OTC Currency Options in the Dollar-Yen Market

OTC derivatives activities can exacerbate disturbances in underlying markets—even some of the largest markets, such as foreign exchange markets. This was, for example, the case in the dollar-yen market in March 1995 and October 1998; once the yen had appreciated beyond a certain level, the cancellation of OTC knockout options and the unwinding of associated hedging positions fueled the momentum toward further appreciation.[1] During these periods of heightened exchange rate volatility, OTC derivatives activities also significantly influenced exchange-traded option markets, because standard exchange-traded options were used by derivatives dealers as hedging vehicles for OTC currency options.

In 1995, the yen appreciated vis-à-vis the dollar from ¥101 in early January to ¥80 in mid-April, strengthening by 7 percent in four trading sessions between March 2 and March 7. A combination of macroeconomic factors was widely cited as having contributed to the initial exchange rate move. The speed of the move also suggests that technical factors (such as the cancellation of knockout options) and short-term trading conditions (such as the unwinding of yen-carry trades, also involving OTC derivatives) reinforced the trend. In early 1995, relatively large volumes of down-and-out dollar put options were purchased by Japanese exporters to partially hedge the yen value of dollar receivables against a moderate yen appreciation.

In September–October 1998, the yen appreciated again sharply vis-à-vis the dollar from ¥135 to ¥120 per dollar. Of particular interest are the developments during October 6–9, 1998, when the yen strengthened by 15 percent vis-à-vis the dollar. Talk of an additional fiscal stimulus package in Japan and a reassessment of the relative monetary policy stances in Japan and the United States may have sparked the initial rally in the yen and corresponding weakening in the dollar. The initial spate of dollar selling, in turn, was viewed as having created the sentiment that the dollar's long-standing strengthening vis-à-vis the yen had run its course. But, as in March 1995, in addition to reversals of yen-carry trades, knockout options were widely viewed as having provided additional momentum that boosted demand for yen and contributed to the dollar selling.

Knockout options (a type of OTC barrier option) differ from standard options in that they are canceled if the exchange rate reaches certain knockout levels, and therefore leave the investor unhedged against large exchange rate movements. Nonetheless, they are widely used since they are less expensive than standard options. In 1995 and 1998, knockout options, particularly down-and-out put options on the dollar, amplified exchange rate dynamics through two separate channels: (1) Japanese exporters who bought knockout options to protect against a moderate depreciation of the dollar sold dollars into a declining market when the knockout options were canceled to prevent further losses on their dollar receivables; and (2) dynamic hedging strategies employed by sellers of knockout options required the sudden sale of dollars after the knockout levels had been reached (see Box 4.4). Ironically, OTC knockout options that protect only against moderate exchange rate fluctuations can sometimes increase the likelihood of large exchange rate movements—the very event they do not protect against.

Although knockout options represented a relatively small share of total outstanding currency options (between 2 and 12 percent), they had a profound effect on the market for standard exchange-traded options. It is easy to see why: knockout options are sometimes hedged by a portfolio of standard options. Dealers who employed this hedging technique needed to buy a huge amount of standard options at the same time as other market participants were trying to contain losses from canceled down-and-out puts. As a consequence, prices of exchange-traded put options (implied volatilities) doubled in March 1995 and almost doubled in October 1998.

[1]See IMF (1996 and 1998b, Box 3.1) and Malz (1995).

Box 4.2. LTCM and Turbulence in Global Financial Markets[1]

The turbulent dynamics in global capital markets in late 1998 had been preceded by a steady buildup of positions and prices in the mature equity and bond markets during the years and months preceding the Russian crisis in mid-August 1998 and the near-collapse of the hedge fund LTCM in September. The bullish conditions in the major financial markets continued through the early summer of 1998, amid earlier warning signs that many advanced country equity markets, not just in the United States, were reaching record and perhaps unsustainable levels. As early as mid-1997, differences in the cost of borrowing between high- and low-risk borrowers began to narrow to the point where several advanced country central banks sounded warnings that credit spreads were reaching relatively low levels and that lending standards had been relaxed in some countries beyond a reasonable level. A complex network of derivatives counterparty exposures, encompassing a very high degree of leverage, had accumulated in the major markets through late summer 1998. The credit exposures and high degree of leverage both reflected the relatively low margin requirements on over-the-counter derivative transactions and the increasingly accepted practice of very low, or zero, "haircuts" on repo transactions.

Although the weakening of credit standards and complacency with overall risk management had benefited a large number of market participants, including a variety of highly leveraged institutions (HLIs), LTCM's reputation for having the best technicians as well as its high profitability during its relatively brief history earned it a particularly highly valued counterparty status. Many of the major internationally active financial institutions actively courted LTCM, seeking to be LTCM's creditor, trader, and counterparty. By August 1998, and with less than $5 billion of equity capital, LTCM had assembled a trading book that involved nearly 60,000 trades, including on-balance-sheet positions totaling $125 billion and off-balance-sheet positions that included nearly $1 trillion of notional OTC derivative positions and more than $500 billion more of notional exchange-traded derivatives positions. These very large and highly leveraged trading positions spanned most of the major fixed income, securities, and foreign exchange markets, and involved as counterparties many of the financial institutions at the core of global financial markets.

Sentiment weakened generally throughout the summer of 1998 and deteriorated sharply in August when the devaluation and unilateral debt restructuring by Russia sparked a period of turmoil in mature markets that was virtually without precedent in the absence of a major inflationary or economic shock. The crisis in Russia sparked a broad-based reassessment and repricing of risk and large-scale deleveraging and portfolio rebalancing that cut across a range of global financial markets. In September and early October, indications of heightened concern about liquidity and counterparty risk emerged in some of the world's deepest financial markets.

A key development was the news of difficulties in, and ultimately the near-failure of, LTCM, an important market-maker and provider of liquidity in securities markets. LTCM's size and high leverage made it particularly exposed to the adverse shift in market sentiment following the Russian event. On July 31, 1998, LTCM had $4.1 billion in capital, down from just under $5 billion at the start of the year. During August alone, LTCM lost an additional $1.8 billion, and LTCM approached investors for an injection of capital.

In early September 1998, the possible default and/or bankruptcy of LTCM was a major concern in financial markets. Market reverberations intensified as major market participants scrambled to shed risk with LTCM and other counterparties, including in the commercial paper market, and to increase the liquidity of their positions. LTCM's previous "preferred creditor" status evaporated, its credit lines were withdrawn, and margin calls on the fund acceler-

[1]This box draws on the analysis in IMF (1998b, 1999).

Box 4.2 *(concluded)*

ated. The major concerns were the consequences—for asset prices and for the health of LTCM's main counterparties—of having to unwind LTCM's very large positions as well as how much longer LTCM would be able to meet mounting daily margin calls. As a result, LTCM's main counterparties demanded additional collateral, including Bear Stearns, LTCM's prime brokerage firm, which on September 21 required LTCM to put up additional collateral to cover potential settlement exposures. Default by as early as September 23 was perceived as a very real possibility for LTCM in the absence of an injection of capital.

In response to these developments and the rapid deleveraging, market volatility increased sharply, and there were some significant departures from normal pricing relationships among different asset classes. In the U.S. treasury market, for example, the spread between the yields of "on-the-run" and "off-the-run" treasuries widened from less than 10 basis points to about 15 basis points in the wake of the Russian debt restructuring, and to a peak of over 35 basis points in mid-October, suggesting that investors were placing an unusually large premium on the liquidity of the "on-the-run" issue. Spreads between yields in the eurodollar market and on U.S. treasury bills for similar maturities also widened to historically high levels, as did spreads between commerical paper and treasury bills and those between the fixed leg of fixed-for-floating interest rate swaps and government bond yields, pointing to heightened concerns about counterparty risk. Interest rate swap spreads widened in currencies including the U.S. dollar, deutsche mark, and pound sterling. In the U.K. money markets, the spread of sterling interbank rates over general collateral repo rates rose sharply during the fourth quarter, partly owing to concerns about liquidity and counterparty risk (and also reflecting a desire for end-of-year liquidity).

As securities prices fell, market participants with leveraged securities positions sold those and other securities to meet margin calls, adding to the decline in prices. The decline in prices and rise in market volatility also led arbitrageurs and market-makers in the securities markets to cut positions and inventories and withdraw from market-making, reducing liquidity in securities markets and exacerbating the decline in prices. In this environment, considerable uncertainty about how much an unwinding of positions by LTCM and similar institutions might contribute to selling pressure fed concerns that the cycle of price declines and deleveraging might accelerate.

In response to these developments, central banks in major advanced economies cut official interest rates. In the United States, an initial cut on September 29 failed to significantly calm markets; spreads continued to widen, equity markets fell further, and volatility continued to increase. Against this background, the Federal Reserve followed up on October 15 with a cut in both the federal funds target and the discount rate, a key policy action that stemmed and ultimately helped reverse the deteriorating trend in market sentiment. The easing—coming so soon after the first rate cut and outside a regular Federal Open Market Committee (FOMC) meeting (the first such move since April 1994)—sent a clear signal that the U.S. monetary authorities were prepared to move aggressively if needed to ensure the normal functioning of financial markets.

Calm began to return to money and credit markets in mid-October. Money market spreads declined quickly to precrisis levels, while credit spreads declined more slowly and remained somewhat above precrisis levels, probably reflecting the deleveraging. The Federal Reserve cut both the federal funds target and the discount rate at the FOMC meeting on November 17, noting that although financial market conditions had settled down materially since mid-October, unusual strains remained. Short-term spreads subsequently declined. The calming effect of the rate cuts suggested that the turbulence stemmed primarily from a sudden and sharp increase in pressures on (broadly defined) liquidity, including securities market liquidity, triggered by a reassessment of risk.

(credit) risk is decentralized and located within individual institutions; (2) there are no formal centralized limits on individual positions, leverage, or margining; (3) there are no formal rules for risk- and burden sharing; and (4) there are no formal rules or mechanisms for ensuring market stability and integrity, and for safeguarding the collective interests of market participants.

Broad Similarities, but Important Differences, in Contract Structure

Derivatives offer significant benefits because they facilitate the unbundling and transformation of financial risks such as interest rate and currency risk (see Box 4.3). Individual components of risk can be isolated, individually priced, repackaged, and if desired traded. In this way, derivatives allow agents to tailor more precisely the risk characteristics of financial instruments to their risk preferences and tolerances. By contributing to more complete financial markets, derivatives can improve market liquidity and increase the capacity of the financial system to bear risk and intermediate capital.

Both exchange-traded and OTC contracts offer these benefits in broadly similar ways. However, exchange-traded contracts have rigid structures compared with OTC derivatives contracts. For example, the Chicago Board of Trade's treasury bond futures contract dictates (1) how many treasury bonds must be delivered on each futures contract; (2) the types of treasury bonds acceptable for delivery; (3) the way prices are quoted; (4) the minimum trade-to-trade price change; (5) the months in which contracts may expire; and (6) how treasury bonds may be delivered from the seller of the contract to the buyer. Another key difference is that exchange-traded contracts are regulated, often by both a regulatory authority and an exchange's self-regulatory organization. In the United States, the Securities and Exchange Commission (SEC) regulates exchange-traded derivatives that are legally "securities" (e.g., certain options); the Commodity Futures Trading Commission (CFTC) regulates those that are legally "commodities" (e.g., financial futures). Regulations promote investor protection, as exchange members act as agents for customers; market integrity, against the potential for manipulation when supplies of underlying goods, securities, or commodities are limited; and efficient price discovery, an important function of exchange-traded derivatives.[6]

According to market participants, in the exchange environment, regulatory authorities evaluate proposed new contracts in a time-consuming and costly process. By contrast, OTC derivatives contracts can involve any underlying index, maturity, and payoff structure. OTC contracts can fill the gaps where exchange-traded contracts do not exist, including exotic currencies and indices; customized structures (see Box 4.4); and maturities that are tailored to other financial transactions. Nonetheless, some OTC derivatives instruments have become "commoditized," as market conventions and de facto standards for payments frequencies, maturities, and underlying indexes have emerged. About two-thirds of OTC derivatives gross market value is accounted for by simple forwards and swaps, many of which could be traded on an exchange except for minor differences in maturity dates, notional amounts, and underlying indexes (see Figure 4.1 and Box 4.5).

In addition, OTC derivatives instruments are lightly and indirectly regulated, often because they fall between regulatory gaps. In the United States, for example, swaps contracts are classified neither as "securities" nor as "commodities," and so are regulated neither by the SEC nor the CFTC. Many justifications for regulating exchange-traded derivatives contracts are not relevant for OTC derivatives. As was recognized by U.S. courts (*Procter and Gamble v. Bankers Trust),* they are principal-to-principal agreements between sophisticated counterparties, and investor protection is not regarded as an important issue. In addition, there is minimal risk of manipula-

[6]See United States, President's Working Group on Financial Markets (1999).

Box 4.3. Motives for OTC Derivatives Transactions

While OTC derivatives in the form of forwards in agricultural goods date back to the 15th century, and perhaps earlier (the first options trade is attributed to the Greek philosopher Thales circa 600 B.C.), the modern forms of OTC derivatives originated in incentives from three sources: (1) economic incentives, including the need to share and hedge risk; (2) restrictions on financial activity, including regulation, investment restrictions, and taxation of financial transactions; and (3) the internationalization of finance and the associated technological and methodological advances. Three historical examples illustrating the use of OTC derivatives show how these incentives shaped OTC derivatives markets.

First, the market for interest rate swaps grew out of a desire to exploit differential interest rate advantages for borrowing at fixed versus floating rates. For example, suppose a low-rated bank has to pay 100 basis points more than a high-rated bank when borrowing at fixed rates, while it has to pay only 10 basis points more than the high-rated bank when borrowing at floating rates. In this case, the two banks could profit from each bank's comparative advantage: the low-rated bank would borrow at floating rates, the top-rated bank would borrow at fixed rates, and both banks would exchange the cash flows.[1] These types of transactions gave rise to the interest rate swap market. Initially, banks and other financial institutions served as brokers by matching buyers and sellers for a fee. But this activity ultimately evolved into the current OTC derivatives markets in which the internationally active commercial and investment banks actively trade and manage very large portfolios of swaps, including for their own proprietary accounts. Interest rate swaps presently account for about two-thirds of OTC derivatives market activity in interest rate contracts.

Second, consider the market for currency swaps. These derivatives instruments arose from a need by multinationals to make foreign currency investments in the presence of policy measures designed to discourage capital outflows and thus limit pressures on exchange rates. For example, in the 1970s, the U.K. government imposed taxes on sterling foreign exchange transactions. As a result, it was more costly to borrow dollars in London than in New York. Multinational corporations set up parallel and back-to-back loans to circumvent the tax and lower the cost to U.K. companies of borrowing dollars.[2] These arrangements avoided the tax on foreign exchange transactions, because each leg involved the U.S. and U.K. companies borrowing and lending dollars in the United States and sterling in the United Kingdom. The modern currency-swap markets developed as companies seeking to engage in these transactions turned to the major financial institutions to find overseas counterparts with matching interests. Now these markets are used for a variety of commercial purposes, including arbitraging differences in national interest rates.

Third, take, for example, the market for credit derivatives (which are indexed to credit risk). For many financial institutions, the bulk of financial risk is credit risk. Credit derivatives permit these institutions to adjust their credit risk profiles and increase the efficiency of their economic and regulatory capital.[3] By using a credit derivative, for example, the holder of a sovereign bond can mitigate the risk of sovereign default and retain the currency and interest rate risk. Credit derivatives are presently a small share of the overall market, but promise strong growth in the future and may come to play a key role in pricing, trading, and managing credit risk.

[1]See Lau (1997), p. 26. An alternative interpretation of this "pure" comparative advantage swap is that it transfers the credit risk to the high-rated borrower.

[2]The eurodollar market emerged in the 1960s partly in response to the U.S. Interest Equalization Tax and the Foreign Credit Restraint Program; see Grabbe (1991), p. 14.

[3]One major institution reportedly used credit derivatives to halve the economic capital absorbed by its credit portfolio. See Smith (2000), p. v.

Box 4.4. Exotic Options

The flexibility of OTC derivatives contracts allows unusual contract structures to be traded, including in options.[1] In a standard option, the buyer pays a fee (premium) up front, and receives an option to either buy (call option) or sell (put option) the underlying security at a specified price (strike price). This right may be exercisable only at maturity (European option) or at any time up until maturity (American option). At exercise, the payoff to the option is the difference between the strike price and the price of the underlying security (its intrinsic value). Options with simple structures such as these are known as "plain vanilla" options.

Exotic options can change any or all of these features:

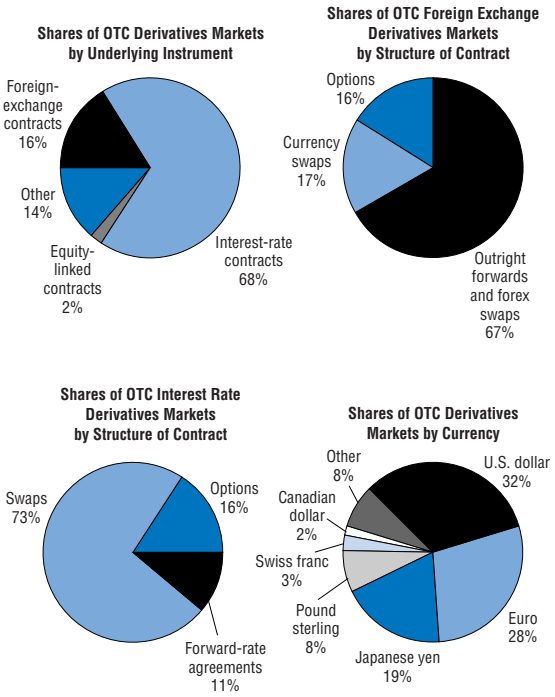
- The option may be exercisable at several fixed points in time (Bermuda option).
- The premium can be paid at maturity, rather than at initiation (break forward, Boston option).
- The option can start with a delay (forward start option) (as with some employee incentive stock options).
- The underlying can be another option, rather than an underlying security (compound options); for example, an option on an interest-rate cap (caption) or floor (floortion).
- The underlying may be another derivative, for example, a swap (swaption).
- The holder may pick at some point whether the option is a call or put option (chooser option).
- Barrier options are canceled (knockout) or activated (knock-in) when a price threshold is crossed.
- Binary options pay a fixed amount (cash or nothing option) or full asset value (asset or nothing option).
- The payoff may depend on the maximum or minimum price attained by the underlying (look back option) or on the average price of the underlying during the life of the option (Asian option).
- During the contract's life, the holder may be able to pick a day, and at expiration receive the maximum of the intrinsic value on that day and the intrinsic value at maturity (shout option).
- The payoff may depend on the prices of several underlying securities (rainbow, basket, exchange options).
- The option may have a payoff that is nonlinear in the underlying price (power caps).
- The option's payoff may be denominated in a different currency than the underlying (quanto).
- Many variations either combine one or more of these features, or amount to portfolios of options.

Exotic options raise a number of challenges for the financial institutions that trade them. They can be exceedingly challenging to price; options for which the payoff depends on the price history may not have a closed form solution for the price. In addition, they can be very challenging to hedge. Options are traditionally dynamically hedged by holding a quantity of the underlying security, which is periodically adjusted for changes in the price of the underlying security.[2] How much of the underlying security is held depends upon how the option's price responds to changes in the underlying; this response can change dramatically for exotic options. Suppose, for example, that when the price of the underlying security rises by one dollar, the price of an option on one unit of the underlying rises by 50 cents; in market parlance, the option's delta (change with respect to the underlying) is 0.5. A portfolio of two options, and one unit of the underlying, is then perfectly hedged. However, the value of delta changes with the price of the underlying security. For knockout options, the value of delta declines sharply to zero as the barrier is approached. This has the potential to suddenly unbalance the hedged position and cause a sudden rush of sales or purchases of the underlying security to rebalance the portfolio.

[1]See, for example, Hull (2000), Chapter 18. These "exotic" structures may be nonstandard and complex, but they are not necessarily rare, thinly traded, or especially risky.

[2]Another approach is to hedge using a portfolio of other options constructed to automatically adjust for changes in the underlying security (static hedging).

Figure 4.1. Structure of the Over-the-Counter (OTC) Derivatives Markets, End-December 1999[1]



Source: Bank for International Settlements (2000).
[1]Figures are based on notional amounts outstanding.

tion in OTC derivatives markets, since contracts do not serve a price-discovery role as do exchange-traded derivatives.[7]

OTC and exchange markets are viewed by market participants as existing in parallel, and OTC contracts are hedged by using standard, exchange-traded derivatives. The major participants who benefit most from OTC derivatives markets envision that exchange-traded derivatives will remain an important part of their risk management toolbox, and that organized exchange markets will continue to exist alongside OTC markets.

Organization of Derivatives Trading and Corresponding Frameworks for Promoting Market Stability

Apart from contract flexibility, the most salient differences between OTC and exchange-traded derivatives lie in the organization of trading and the corresponding frameworks for promoting market stability. Trading, clearing and settlement, risk management, and contingency management (handling a clearing-member default, for example) are highly formalized and centralized in exchange markets, but are informal, bilateral, and comparatively decentralized in OTC markets.

Organized Exchange Markets: Centralized, Formal, Regulated, Rule-Driven

Organized exchange trading has several components: (1) membership requirements; (2) rules governing conduct (including risk management); (3) centralized trading, clearing, and settlement; and (4) rules that mutualize risk, including loss sharing in case of defaults. These rules are designed to ensure market integrity, promote efficient price discovery, and safeguard the resources of the clearinghouse. A clearinghouse may be part of the exchange, or a separate legal entity. Exchange members normally commit capital or have an ownership interest in the clearinghouse.

[7]See Greenspan (2000).

Box 4.5. The Life of a Two-Year Interest Rate Swap

Suppose that a company owns a $100 million, two-year bond that pays semiannual fixed interest at 10 percent, but would prefer a floating-rate bond. Instead of selling the fixed-rate bond and buying a floating-rate bond, it can convert the fixed-rate bond's cash flows from fixed to floating by entering with an intermediary a two-year interest rate swap in which it pays a fixed rate of interest and receives a floating rate (for dollar-denominated interest rate swaps, the floating-rate index is often LIBOR, or the rate on treasury bills, commercial paper, or federal funds). In this case, the company will be the "fixed-rate payer" and the intermediary will be the "fixed-rate receiver."

The company phones an intermediary to obtain a quote on such a swap. Swap rates are normally quoted by reference to the interest rate on the fixed leg of the transaction and expressed as a spread over treasury rates. The intermediary offers to pay LIBOR flat in return for 8 percent fixed interest. The rate of 8 percent is then the swap rate or swap coupon on this two-year swap. The swap rate is normally expressed as the semiannual yield to maturity on the fixed-rate leg against a flat floating rate. It is typically quoted in terms of a spread to treasury rates of the same maturity. Suppose that the two-year treasury note yields 7.75 percent. The swap spread quoted to the company is then 25 basis points.

Swap rates may be either on market—that is, calculated using prevailing interest rates and with a standard payment frequency, notional amount, and floating-rate index—or off market, with one or more of these aspects customized (standardized swaps are also known as "plain vanilla" swaps). For short-dated, U.S. dollar interest rate swaps, on-market swap rates are calculated from eurodollar futures rates. For this two-year swap, the intermediary would first compound the yields on eight successive three-month eurodollar contracts to arrive at the swap rate.[1] The intermediary would then add and subtract small amounts (perhaps a few basis points) to reflect credit risk and the cost of doing business to arrive at the fixed rates that it would be willing to receive and pay on swaps; the difference between the intermediary's "receive" and "pay" rates is the bid-ask spread.

If the company accepts the swap arrangement, the intermediary fills out and sends a confirmation form that spells out the details of the swap, including the floating-rate index, the frequency of payment, and any arrangement for collateral. The company checks, signs, and returns the confirmation. If the intermediary and company have a master agreement between them, the swap may be encompassed by that agreement; if not, the intermediary may use a more detailed confirmation (a long-form confirmation) that sets out many of the considerations that are normally covered in the master agreement. The date that the deal is agreed is known as the trade date; interest begins to accrue on the effective date (perhaps five business days later), and any initial cash flows are exchanged on the settlement date (often the same as the effective date).

The company has now in effect converted the fixed-rate bond that pays 10 percent to a floating-rate bond that pays LIBOR plus 2 percent: the company receives 10 percent from the bond, pays 8 percent on the swap, and receives LIBOR. The intermediary now may have an open exposure to interest rates, depending on the configuration of swaps and other instruments on its books. The intermediary may choose to hold the position, enter an offsetting swap (paying fixed rates and receiving floating), or hedge the position using U.S. treasury securities or eurodollar futures.

The intermediary also enters the details of the swap into the data management system, capturing the important details in the firm's risk management system, which would calculate the exposure to the company net of any other positions. In a standard, on-market swap, the expected present value of the swap is zero, so no cash changes hands up front. However, both the

[1]See Marshall and Kapner (1993), Chapter 7. The two-year swap would be viewed as "short-dated" since liquid eurodollar futures are available out to two years. Pricing long-dated swaps is more complicated; see Marshall and Kapner (1993), pp. 154–163.

Box 4.5 *(concluded)*

Period Ending	Six-Month LIBOR	Fixed Interest Payment (from Company)	Floating-Rate Payment (from Intermediary)	Net Payment from Intermediary to Company
December 2000	6 percent			
June 2001	7 percent	$8 million	$6 million	–$2 million
December 2001	8 percent	$8 million	$7 million	–$1 million
June 2002	9 percent	$8 million	$8 million	None
December 2002	. . .	$8 million	$9 million	$1 million

intermediary and the company have potential future exposure (PFE) (see Box 4.6). Accordingly, one or both may have the right to take collateral up front (in arrangements like the one described, normally only the intermediary has the right to take collateral). Moreover, as market rates change, and PFE fluctuates, both current exposure and PFE may rise, and the intermediary may make collateral calls (as well as rehedging market risk exposure).

After six months, the first "reset" period is reached, and the first payment is due. The size of the gross and net payments depends upon the six-month LIBOR at the beginning of the period when the deal was struck. Suppose that the six-month LIBOR was 6 percent. The company is obligated to pay 8 percent of $100 million; the intermediary is obligated to pay 6 percent of $100 million; net, then, the company is obligated to pay the intermediary 2 percent of $100 million, or $2 million (see table). Note that the gross and net flows are considerably smaller than the notional value of $100 million. The market value of the swap would likewise be small compared to the notional value (perhaps 5 percent of the notional).

This process continues through the end of the life of the swap, at the end of the second year. At that point, the swap agreement expires, and any excess collateral is returned (in a "plain vanilla" interest rate swap, the two counterparties do not exchange principal).

In order to maintain market stability and financial integrity, exchanges impose soundness, disclosure, transparency, and prudential requirements on members. Typically, there are minimum capital requirements; protection of customer funds; reporting; and compliance with other rules and regulations. Exchanges closely monitor trading activity with a view to identifying large customer positions or concentrations of positions. They also promote transparency by reporting positions, turnover, and price data, and determining settlement prices, usually on a daily basis. Following the collapse of Barings, some clearinghouses share information and assess members' net exposures across markets.[8]

The clearinghouse manages credit risk and is the central legal counterparty to every transaction; it has a matched market risk position, but has current credit exposures. Credit risk arises because a change in the price of the underlying asset could cause one counterparty to owe a considerable amount on its position, particularly if the contract is highly leveraged. If an exchange member defaults, the clearinghouse normally has the right to liquidate the member's positions, take the member's security deposit, margin, and performance bonds, attach certain other member assets, and invoke any guarantee from the member's parent company. If the defaulting member's resources cannot cover the obligation, the exchange can normally turn to

[8]See Steinherr (1998), p. 180.

the resources of other clearing members by invoking loss-sharing rules. In the event of member default, most clearinghouses transfer the member's client positions to another member; a few close out the client positions and liquidate the margin. Exchanges also have backup credit lines.[9] Overall, clearinghouse defaults have been exceedingly rare.

Most important, exchanges formalize risk-management and loss-sharing rules designed to protect the exchange's capital and the capital of its members. Members are usually, but not always, required to keep speculative positions within strictly defined limits, mark to market at least daily, and post initial and variation margin to limit the exchange's net credit exposure to the member. Members are subject to surprise inspections and surveys of their financial condition, compliance with exchange rules, and risk management abilities. Likewise, there are rules that protect the exchange and its members from trading activities of nonmembers, which must trade through members. For example, on some exchanges, members of the exchange need not be members of the clearinghouse, but trades must be cleared through clearinghouse members. Exchanges also dictate minimum margin requirements for member exposures to clients (often higher than the requirements for members), as well as client position limits. In addition, clearing members handling clients' accounts may face more stringent capital requirements compared with those only trading on their own account.

OTC Markets: Decentralized, Informal, Lightly Supervised and Regulated, Market-Discipline Driven

By contrast, OTC derivatives markets lack a formal structure. There are no membership criteria, but counterparties prefer to deal only with highly rated and well-capitalized intermediaries to minimize counterparty risk. OTC derivatives markets are similar to interbank and interdealer markets. They comprise an informal network of bilateral relationships, and there is no physical central trading place. Instead, the OTC derivatives markets exist on the collective trading floors of the major financial institutions. There is no central mechanism to limit individual or aggregate risk taking, leverage, and credit extension, and risk management is completely decentralized. Market participants individually perform risk management, in particular the management of the credit risk in the bilateral, principal-to-principal agreements, which is particularly challenging because exposures vary with the price of the underlying security and can rise very sharply (see Box 4.6).

The operational aspects of OTC derivatives markets are also decentralized. There is no centralized trading, clearing, or settlement mechanism in OTC markets. Transparency is generally limited as well. Except for semiannual central-bank surveys, market participants do not report outstanding positions or prices for aggregation or dissemination. Information about market concentration and who owns which risks is generally unavailable; at best, a trading desk might know that some institutions are building up positions. This lack of transparency enabled LTCM to build up outsized positions during 1997 and 1998.[10]

OTC instruments and trading are essentially unregulated, although they are affected indirectly by national legal systems, regulations, banking supervision, and market surveillance. None of the major financial centers has an "OTC derivatives regulator" similar to a banking or a securities regulator.[11] Market participants create instruments to minimize regulatory burdens (including capital requirements), and in many jurisdictions, supervisory and regulatory frameworks impinge only indirectly on OTC de-

[9]See Kroszner (1999).

[10]See IMF (1999), Chapter IV.

[11]Among the exceptions, in Brazil all OTC derivatives transactions must be centrally registered. See United States, Commodity Futures Trading Commission (1999), pp. 64–65.

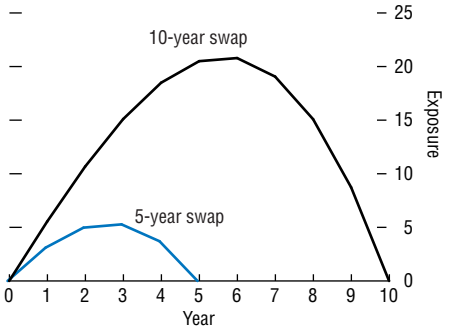
Box 4.6. Measuring Potential Future Exposure in a Swap Contract

Sharp losses during periods of market turbulence have led to an increased focus on counterparty credit risk in OTC derivatives. This credit risk includes current and potential exposure. Potential future exposure (PFE) is then the maximum, the average, or some percentile (for example, the 95th percentile) of the distribution of exposure that might be attained in the future. This distribution (based on simulated future paths for the price of the underlying asset) is known as an exposure profile.

The exposure profile and PFE depend importantly upon the key characteristics of the underlying cash flows, particularly their maturity. For example, exposure tends to rise with maturity because the potential drift in the price of the underlying security also increases with maturity (the diffusion effect). At the same time, the remaining maturity of the contract, and the number of future payments that might be at risk, decrease with the passage of time (the amortization effect).[1] When the diffusion effect is stronger (typically in the early days of the contract's life), the exposure profile rises with time; when the amortization effect is stronger, the exposure profile falls with time. For contracts where principal is exchanged, the exposure profile usually rises continuously until maturity; for others, such as interest rate swaps, the exposure profile is usually hump-shaped.

A simple example can illustrate the principle of exposure profiles and PFE. Consider a very simple interest rate swap in which the holder pays a floating rate and receives a fixed rate of interest (12 percent) once a year on a notional principal of $100 million over five years. In practice, calculating the PFE on even this simple swap is complicated, because changes in both the level and shape of the yield curve can give rise to large changes in the value of the swap, and because the yield curve evolves over time in a complicated way. To simplify, then, suppose that (1) the yield curve is initially flat, and remains flat—short-term and long-term interest rates are always exactly the same; (2) interest rates follow a simple process: they start at 12 percent; every year, interest rates either increase by 1 percentage point, decline by 1 percentage point, or remain unchanged. The valuation of the swap is then very simple; at each point in time, the floating-rate leg is priced at par, and the fixed-rate leg is priced as if it were a fixed-rate bond with a 12 percent coupon. At inception and expiration, the swap is worth zero, since the interest rates on the floating (paying) and fixed (receiving) legs are the same and the cash flows are identical.

Potential Future Exposure for Two Interest-Rate Swaps
(In millions of U.S. dollars)



The table shows the evolution of interest rates and the value of the swap. If interest rates fall, the value of the swap to the fixed-rate receiver rises (for the same reason that the price of a fixed-rate bond rises), creating credit exposure to the counterparty. If interest rates decline to 11 percent in the first year, for example, the value of the swap to the fixed-rate receiver rises to $3.1 million. If they decline further to 10 percent in the second year, the value of the swap rises further to about $5 million. The maximum exposure is at the lowest level of interest rates that can be attained; the diffusion effect means that interest rates can fall further in years that are farther from inception. As the figure shows, at three years, exposure peaks at about $5.3 million, at which point the amortization effect begins to dominate the diffusion effect. Measuring PFE by maximum exposure, then, the PFE for the five-year swap is $5.3 million. Comparing a ten-year swap gives a perspective on the importance of maturity (see the second panel of the table). Maximum exposure on the ten-year swap peaks at six years at almost $21 million, about four times the maximum exposure on the five-year swap.

[1]See Lau (1997), Chapter 5.

Potential Exposure Paths for Two $100 Million Notional Fixed-for-Floating Interest Rate Swaps[1]

Five-Year Swap	Year					
Interest Rate	0	1	2	3	4	5
17%						$0
16%					($3,448,276)	$0
15%				($4,877,127)	($2,608,696)	$0
14%			($4,643,264)	($3,293,321)	($1,754,386)	$0
13%		($2,974,471)	($2,361,153)	($1,668,102)	($884,956)	$0
12%	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
11%		$3,102,446	$2,443,715	$1,712,523	$900,901	$0
10%			$4,973,704	$3,471,074	$1,818,182	$0
9%				$5,277,334	$2,752,294	$0
8%					$3,703,704	$0
7%						$0
Max.	$0	$3,102,446	$4,973,704	$5,277,334	$3,703,704	$0

Ten-Year Swap	Year										
Interest Rate	0	1	2	3	4	5	6	7	8	9	10
22%											$0
21%										($7,438,017)	$0
20%									($12,222,222)	($6,666,667)	$0
19%								($14,979,417)	($10,825,507)	($5,882,353)	$0
18%							($16,140,371)	($13,045,638)	($9,393,852)	($5,084,746)	$0
17%						($15,996,731)	($13,716,175)	($11,047,925)	($7,926,072)	($4,273,504)	$0
16%					($14,738,944)	($13,097,175)	($11,192,723)	($8,983,558)	($6,420,927)	($3,448,276)	$0
15%				($12,481,259)	($11,353,448)	($10,056,465)	($8,564,935)	($6,849,675)	($4,877,127)	($2,608,696)	$0
14%			($9,277,728)	($8,576,610)	($7,777,335)	($6,866,162)	($5,827,425)	($4,643,264)	($3,293,321)	($1,754,386)	$0
13%		($5,131,655)	($4,798,770)	($4,422,610)	($3,997,550)	($3,517,231)	($2,974,471)	($2,361,153)	($1,668,102)	($884,956)	$0
12%	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
11%		$5,537,048	$5,146,123	$4,712,196	$4,230,538	$3,695,897	$3,102,446	$2,443,715	$1,712,523	$900,901	$0
10%			$10,669,852	$9,736,838	$8,710,521	$7,581,574	$6,339,731	$4,973,704	$3,471,074	$1,818,182	$0
9%				$15,098,859	$13,457,756	$11,668,954	$9,719,160	$7,593,884	$5,277,334	$2,752,294	$0
8%					$18,491,519	$15,970,840	$13,248,507	$10,308,388	$7,133,059	$3,703,704	$0
7%						$20,500,987	$16,936,056	$13,121,580	$9,040,091	$4,672,897	$0
6%							$20,790,634	$16,038,072	$11,000,356	$5,660,377	$0
5%								$19,062,736	$13,015,873	$6,666,667	$0
4%									$15,088,757	$7,692,308	$0
3%										$8,737,864	$0
2%											$0
Max.	$0	$5,537,048	$10,669,852	$15,098,859	$18,491,519	$20,500,987	$20,790,634	$19,062,736	$15,088,757	$8,737,864	$0

[1]Both swaps have annual resets and payment dates and 12 percent (fixed-rate leg) coupons. For simplicity, analysis assumes a flat yield curve and that interest rates can either decline by 1 percentage point, increase by 1 percentage point, or stay the same every year.

rivatives markets that are geared toward traditional banking and securities activities. Nor is the institutional coverage comprehensive, as hedge funds and unregulated securities affiliates are not regulated. Because financial activities evolve more rapidly than official oversight, the gap between regulator and regulated seems to have widened. Official surveillance of these markets also is limited. Overall, the supervision of financial institutions (including of brokers and dealers) and market surveillance plays a critical but limited role in ensuring the smooth functioning of OTC derivatives markets, primarily by seeking to ensure the overall soundness of the institutions that comprise them.

Regulations are also highly fragmented, both nationally and internationally. In the United States, for example, there are at least three groups of regulators—securities, commodity futures, and banking—impinging on OTC derivatives activities. In addition, while the major market-making institutions flexibly book trades around the globe, supervision and regulation are nationally oriented. Over time, efforts have been made to adapt the current framework, including through the 1995 amendment to the Basel Accord on Capital Adequacy.[12] Authorities acknowledge that significant gaps in coverage remain and new gaps will likely emerge between market practices and official frameworks.

Despite its limited role, the current regulatory framework has had a visible impact on the market. Existing regulation and concerns about possible regulation have influenced the choice of jurisdictions where trading takes place; the type of legal structure (including unregulated subsidiaries) used to handle dealer activities; the structure of trading, clearing, and settlement (including the degree of centralization and automation); and contract design. These choices reflect efforts to minimize or eliminate the impact of regulations (e.g., capital requirements) and also reflect effects of regulatory uncertainty, including about whether regulators might construe types of OTC derivatives as falling under their purview and hence being subject to—for example—more burdensome disclosure and capital requirements.

This light regulation and supervision exists alongside a set of private mechanisms that facilitate smoothly functioning OTC derivatives markets. Market discipline, provided by shareholders and creditors, promotes market stability by rewarding financial institutions based on their performance and creditworthiness. Recent research finds market discipline to be strong only during periods of banking sector stress and volatile financial markets.[13]

Market discipline is present when a firm's private sector financial stakeholders (shareholders, creditors, and counterparties) are at risk of financial loss from the firm's decisions and can take actions to "discipline" the firm and to influence its behavior. Market discipline may operate through share price movements, by constraining the supply of credit, or through the willingness to do business through counterparty relationships. Market discipline in financial markets therefore rests on two key elements: investors' ability to accurately assess a firm's financial condition ("monitoring") and the responsiveness of the firm's management to investor feedback ("influence").[14] Institutions mark their trading books to market daily so that unprofitable decisions and poor risk management can be reflected immediately in measured performance (profits and losses). This informs senior management and, through disclosure, financial stakeholders. These mechanisms have some influence, as demonstrated during the turbulence in 1998 when those institutions that appeared to manage well enjoyed the most buoy-

[12]In the Basel Accord, the credit equivalent of an off-balance-sheet item (the basis for capital requirements) has two components: current replacement cost and add-ons designed to capture potential future credit exposure. Add-on ratios to notional value are specified in a matrix of contract types and remaining maturity. See Basel Committee on Banking Supervision (1995).

[13]See Covitz, Hancock, and Kwast (2000).

[14]See United States, Board of Governors of the Federal Reserve System (1999).

ant stock prices, and creditors of institutions perceived to be less creditworthy refused to roll over credit lines or bond issues and sold their credit instruments in the secondary market. The subsequent reductions in proprietary trading activity seem to have been largely motivated by financial stakeholders' desire for less risky earnings.

In OTC derivatives markets, special obstacles for effective market discipline (both "monitoring" and "influence") tend to be related to information disclosure—one of the fundamental preconditions for effective market discipline. For example, the off-balance-sheet character of derivatives makes it difficult for outside financial stakeholders to evaluate the financial health of an institution and its contingent liabilities. Data on individual exposures are proprietary, and disclosure could diminish potential profits. In addition, competitive pressures and the desire to see order flows can lead creditors to extend credit without insisting on adequate counterparty disclosure, as occurred, for example, with LTCM. Therefore, more emphasis may have to be placed on counterparty monitoring, as there may be significant limits to broader market discipline for complex institutions that are active in the OTC derivatives markets.

Supplementing these mechanisms, a number of industry groups are involved in initiatives designed to support well-functioning OTC derivatives markets, notably the ISDA, the Counterparty Risk Management Policy Group, the Group of Thirty, and the Derivatives Policy Group. Efforts include dissemination of best practices in risk management; standardization and clarification of documentation; identification of gaps in risk-management practices and flaws in the operational infrastructure; assessments of legal and other operational risks; efforts to foster interindustry and public/private dialogues on key issues; and initiatives to voluntarily disclose information to regulatory authorities. The activities of these groups reflect the fact that market participants see it as in their best interest to encourage an orderly, effective, and efficient market, and also to discourage regulation.

Corporate governance monitoring by financial stakeholders and private initiatives imposes discipline on OTC derivatives activities and increases incentives to reflect the degree of counterparty risk in pricing, margins, or collateral. They also create benchmarks against which participants, end users, and regulators can measure progress in dealing with the issues raised in public and private forums. Paradoxically, some of the same factors that complicate market discipline (such as the opacity of OTC derivatives) are also the very factors that make market discipline desirable from the standpoint of financial regulators.

Sources of Instability in OTC Derivatives Activities and Markets

As noted in the past two sections, some of the features of OTC derivatives contracts and markets that provide benefits and enhance efficiency either separately or jointly embody risks to financial market stability. OTC derivatives activities are governed almost exclusively by decentralized private infrastructures (including risk management and control systems, private netting arrangements, and closeout procedures) and market-disciplining mechanisms. By comparison, the more formal centralized rules of exchanges protect the stability and financial integrity of the exchange. In addition, the major financial intermediaries in OTC derivatives markets have access to financial safety nets. Because this can affect their behavior, they are required to adhere to prudential regulations and standards in the form of minimum risk-adjusted capital requirements and accounting and disclosure standards that inform financial stakeholders and to some extent support market discipline. The financial industry also has its own standards and best practices, which are promulgated by various industry groups.

Private, decentralized mechanisms have so far safeguarded the soundness of the internationally active financial institutions, in part because many of them have been well capitalized. However, these mechanisms did not adequately

protect market stability, and markets and countries only remotely related to derivatives activities experienced instability because of spillovers and contagion. For example, while no major institution failed during the mature market turbulence of 1998 surrounding the near-collapse of LTCM, private, decentralized market-disciplining mechanisms failed to prevent the buildup and concentration of counterparty risk exposures within the internationally active financial institutions.

The features of OTC derivatives markets that can give rise to instability in institutions, markets, and the international financial system include the following: (1) the dynamic nature of gross credit exposures; (2) information asymmetries; (3) the effects of OTC derivatives activities on available aggregate credit; (4) the high concentration of OTC derivatives activities in the major institutions; and (5) the central role of OTC derivatives markets in the global financial system.

The first underlying source of market instability is the dynamic nature of gross credit exposures, which are sensitive to changes in information about counterparties and asset prices. This feature played an important role in most of the crises in the 1990s. A disruption that sharply raises credit exposures has the capacity to cause sudden and extreme liquidity demands (e.g., to meet margin calls). Just as traditional banks were not always prepared for sudden abnormally large liquidity demands and withdrawals of deposits during bank runs, today's derivatives market participants may not be prepared for sudden and abnormally large demands for cash that can and do arise in periods of market stress.

A second, well known and related, source is information asymmetries, as in traditional banking.[15] Not having sufficient information on borrowers complicates the assessment of counterparty risks. This problem is exaggerated for the credit exposures associated with OTC instruments because of the price-dependent, time-varying nature of the credit exposures. A counterparty's risk profile can change very quickly in OTC derivatives markets. As a result, information asymmetries in OTC derivatives markets can be more destabilizing than in traditional banking markets because they can quickly lead intermediaries and market-makers to radically scale back exposures, risk taking, and the amount of capital committed to intermediary and market-making functions.

Third, OTC derivatives activities contribute to the aggregate amount of credit available for financing and also to market liquidity in underlying asset markets. The capacity for the internationally active institutions to expand and contract off-balance-sheet credit depends on the amount of *capital* they jointly devote to intermediation and market-making in derivatives markets. This capital can support more or less activity depending on several factors, including the risk tolerances (amount of leveraging) of the intermediaries and market-makers; the underlying cost of internal capital or external financing; and financial sector policies (e.g., capital requirements). A determinant of the cost of capital for OTC derivatives activities is the risk-free interest rate (such as on 10-year U.S. treasury bonds), which is also used for pricing contracts. When underlying financing conditions become favorable, the OTC-intermediation activities can become more profitable and more cheaply funded and the level of activity can expand relative to the base of equity capital in the financial system. This tendency for expansion (and, when conditions change, contraction) can become self-generating, and it can, and has, occasionally become hypersensitive to changes in market conditions.

Fourth, as noted, aggregate OTC derivatives activities are sizable and the trading activity ($1 trillion daily turnover) and counterparty exposures are highly concentrated in the internationally active financial institutions. This makes the institutions and global markets susceptible to a range of shocks and dynamics that impinge on one or more major counterparties. The reason for this concentration is clear. Profitability re-

[15]See Diamond (1984).

quires large-scale investments in information technologies (such as sophisticated risk management systems) and also requires a broad client base and the ability to deal in a wide variety of related cash products. Only the largest organizations with global reach and international networks of clients and distribution channels can effectively compete as the central players in OTC markets. As a result, intermediation and market-making are performed by global institutions, who hold and manage the attendant risks, inter alia, through hedging and trading. The major intermediaries have access to financial safety nets, which may impart an element of subsidy in the pricing of credit and other risks. This is problematic because it could contribute to an overextension of credit. This concentration makes OTC derivatives markets and the institutions trading in them potentially vulnerable to sudden changes in market prices for underlying assets (e.g., interest rates and exchange rates) and in the general market appetite for risk.

Fifth, OTC derivatives activities closely link institutions, markets, and financial centers. This makes them possible vehicles for spillovers and contagion. About half or more of OTC derivatives trading in the largest segments takes place across national borders. Linkages arise from the contracts themselves (currency swaps mobilize liquidity across the major international financial centers) and also through the international institutions that make up these markets. In addition, hedging, pricing, and arbitrage activities link OTC derivatives markets to the major cash and exchange-traded derivatives markets: for example, hedging and arbitrage activities link the market for interest rate swaps and the markets for bonds, interest rate and bond futures, and interest rate options. The interlinkages and the opportunities for arbitrage that they provide add to the efficiency and complexity of the international financial system. At the same time, interlinkages also mean that disruptions in OTC activities necessarily entail spillovers and contagion to these other markets.

To summarize, certain features of OTC derivatives and how they are traded and managed make OTC derivatives markets subject to instability if the wrong combination of circumstances arises. This instability arises, in part, because OTC derivatives markets are centered around the internationally active financial institutions that each are counterparty to tens of thousands of bilateral, price-dependent, dynamic credit exposures embodied in OTC derivatives contracts. OTC derivatives contracts bind institutions together in an opaque network of credit exposures, the size and characteristics of which can change rapidly and, moreover, are arguably not fully understood with a high degree of accuracy even by market participants themselves. These institutions allocate specific amounts of capital to support their perceived current and potential future credit exposures in their OTC derivatives business. However, risk assessments and management of these exposures are seriously complicated by a lack of solid information and risk analyses about the riskiness of both their own positions and those of their counterparties. As a result, this market is characterized by informational imperfections about current and potential future credit exposures and market-wide financial conditions.

The potential for instability arises when information shocks, especially counterparty credit events and sharp movements in asset prices that underlie derivative contracts, cause significant changes in perceptions of current and potential future credit exposures. Changes in perceptions, in turn, can cause very large movements in derivatives positions of the major participants. When asset prices adjust rapidly, the size and configuration of counterparty exposures can become unsustainably large and provoke a rapid unwinding of positions. Recent experience strongly suggests that the ebb and flow of credit exposures among the large internationally active financial institutions can be severely affected by some events, which cannot be easily predicted and which can lead to potentially disruptive systemic consequences.

Weaknesses in the Infrastructure

There are also aspects of the infrastructure for OTC derivatives activities that can lead to a

breakdown in the effectiveness of market discipline and ultimately produce unsustainable market conditions and affect market dynamics, including producing or exacerbating underlying instabilities: (1) inadequate counterparty risk management; (2) limited understandings of market dynamics and liquidity risk; and (3) legal and regulatory uncertainty. All of these areas can be improved through efforts, separately or jointly, by financial institutions, supervisors, and market surveillance.

Inadequate Counterparty Risk Management

Although counterparty risk is now widely understood to be of primary importance, discussions with internationally active financial institutions and supervisory authorities suggest that limited progress has been made so far in improving the management of credit risk associated with OTC derivatives.[16] Progress has been particularly slow in developing techniques for managing the interactions of credit and market risk. Even less well understood are the interactions with liquidity, operational, and legal risk.

Several factors explain this limited progress. First, counterparty disclosure has not improved significantly since 1998. The leading providers of intermediation and market-making services in OTC derivatives markets have serious concerns about the dearth of information supplied by clients. Second, the conceptual and measurement challenges involved in understanding counterparty risk and other risks are unlikely to be resolved soon. Even sophisticated institutions acknowledge that significant additional progress is necessary.

Widespread problems with ex ante counterparty risk assessment and pricing produced turbulence in OTC derivatives markets, in part because incentives for prudent risk taking proved to be insufficient to prevent the buildup and concentration of counterparty risk exposures in the autumn of 1998. After the turbulence, however, some of these same incentives worked better, including the discipline from losses in shareholder value and the associated lower bonuses for managers, and the discipline imposed by senior management in determining the risk culture, in setting risk tolerances, and in implementing risk management and control systems. Thus, experience in the LTCM affair appears to have taught some valuable lessons. It remains to be seen, however, if corrections that are being implemented will prove adequate in the future.

If information to assess creditworthiness is insufficient, the reliance on collateral is generally a reasonable counterparty-risk-mitigation technique. However, the assets held as collateral are subject to market risk and their value can decline precipitously when the protection they offer is most needed, namely, during periods of turbulence when the probability of counterparty default can rise significantly. This risk may not have been adequately accounted for in the management of OTC derivatives trading books.

Institutions acknowledge that there were inadequacies in collateral management and uncertainties about legal claims on collateral. Both contributed to market turbulence in the 1990s by encouraging financial institutions to liquidate collateral into declining markets. In addition, in the run-up to the turbulence of the autumn of 1998, counterparties tended to demand low or no haircuts on collateral, because of competitive pressures and the relatively low cost of funding at that time. These measures could have offered protection against declines in collateral values and helped to reduce pressures to liquidate collateral into declining markets.

According to internationally active financial institutions, globally integrated collateral management systems are being developed to overcome some of these difficulties. But only large institutions can afford, develop, and utilize them. Discussions with market participants suggest that it will most likely take some time (another 12 months from June 2000) before any of the leaders in this field have such systems up and running. Second-tier institutions, including

[16]See Counterparty Risk Management Policy Group (1999).

most hedge funds, seem to have fallen further behind in the application of risk management tools, which may partly explain why some hedge funds have recently withdrawn from some markets and scaled back highly leveraged activities.

Limited Understanding of Market Dynamics and Liquidity Risks

Market participants and officials acknowledge they have a limited understanding of market dynamics in OTC derivatives markets and their implications for related markets. Views diverge on whether OTC markets absorb financial shocks or whether they amplify shocks and contribute to volatility. Some believe derivatives markets dissipate shocks by facilitating hedging, while others see these markets as a channel of contagion. Market participants also disagree about how OTC derivatives markets affect the distribution and mix of credit, market, liquidity, operational, and legal risks. One view is that they redistribute risks to those most willing to hold them. Another is that they transform risks in ways that are inherently more difficult to manage because, while reducing market risk, they create credit, operational, and legal risk. Views on relationships between liquidity in derivatives, secondary, and money markets vary considerably. Finally, there is widespread uncertainty about how monetary conditions influence prices and liquidity in OTC derivatives markets.

Market participants acknowledge that they failed to realize the importance of liquidity risk in OTC derivatives, and that the capacity to manage it is still in an embryonic stage. One common mistake was that risk management systems assumed that markets would remain liquid and price changes would follow historical norms. Risk managers also failed to engage in stress testing that examined the implications of severe liquidity problems. Few firms were, for the purposes of risk management, marking credit exposures to estimated liquidation values instead of to current market values. Even these firms seemed to rely on stress tests that did not fully capture the dynamics that were revealed in 1998.

Marking positions to liquidation values is likely to become standard practice at sophisticated financial institutions. However, liquidation values may not be uniquely determined, because asset prices are widely seen as behaving in nonlinear ways at stress points. Thus, even sophisticated institutions will make modeling errors. Less sophisticated firms may rely on margining requirements and haircuts. But this too has its limitations in times of stress: reliance on margin calls to limit counterparty credit risk, normally an effective risk management tool, also can contribute to liquidity pressures in apparently unrelated markets and can raise the likelihood of default by financial institutions that would be solvent under normal market conditions. Likewise, overreliance on VaR and mark-to-market accounting, and other rules that encourage frequent portfolio rebalancing, can induce large-scale selling of positions.[17]

To address the challenges posed by liquidity risks and market dynamics, sophisticated institutions are beginning to focus on the total risk they face rather than on the individual risks (market, credit, liquidity, operational, and legal risk) separately. Particularly challenging is the link between liquidity and counterparty risk, which may depend on the underlying trading, risk mitigation, and legal infrastructure. Liquidity risk can become closely linked to credit risk, because a loss of liquidity can depress market prices and increase the credit exposure on OTC derivatives. Conversely, heightened concerns about counterparty credit risk can precipitate a loss of liquidity by causing market participants to pull back from markets. International financial institutions recognize the need to incorporate linkages into risk management systems, and the formidable challenges of measuring and modeling them. The September 1998 market turbulence may have been the first event that revealed the importance of these linkages, so institutions may still lack sufficient experience

[17]See Schinasi and Smith (1999).

to incorporate them into their stress tests in a reliable way. Future improvements in the management of total risk should contribute to the smooth functioning of OTC derivatives markets.

Legal and Regulatory Uncertainties

Another important source of weakness in the financial infrastructure is legal and regulatory uncertainty.[18] This type of uncertainty encompasses the possibility that private arrangements to mitigate risks (such as definitions of default and legality of closeout and netting arrangements) may turn out to be ineffective. To the extent that risk mitigation fails to work as designed, misperceptions, mispricing, and misallocation of financial risk can result. Legal and regulatory uncertainties can also be important sources of liquidity risk, because they can contribute to adverse market dynamics.

Cumbersome closeout procedures and uncertain enforcement of security interests in collateral can be impractical and ineffective in protecting firms against default. According to market participants, such concerns contributed to the rapid liquidation of collateral in the autumn of 1998. But closeout procedures are as legally uncertain now as they were then. The uncertainty arises because of important differences in bankruptcy laws among countries. Specifically, a number of countries do not allow the termination of contracts upon the initiation of insolvency proceedings, giving the trustee the opportunity to continue those contracts that are favorable to the estate ("cherry picking"). Moreover, even among countries that allow for the termination of contracts, some do not allow for the automatic set-off of contractual claims, which is necessary for netting and closeout. Regarding the enforceability of security interests in collateral, there is a growing convergence among national bankruptcy laws to allow for the stay on the enforcement of security interests. In these cases, the law will often provide that the interest of secured creditors will be protected during the stay (for example, by compensating for the depreciation of the value of the collateral). One uncertainty that arises in many countries is whether such protection will be provided and, if so, whether it will be adequate.

When market participants cannot close out positions or reclaim collateral as specified in private contracts, collateral does not give the expected protection against credit risk. When this is realized in "real time," credit risk can quickly cross a threshold and is perceived as a default event. With this kind of uncertainty, firms holding collateral with creditor-stay exemptions (which allow counterparties to close out exempt OTC derivative transactions outside of bankruptcy procedures) have the incentive to exercise their legal right to sell collateral. Closeout valuations require three to five market quotes per contract, and a derivatives desk may have thousands of contracts with a single counterparty. A dealer attempting to close out roughly the number of swaps with LTCM might have had to collect 16,000 market quotes from other dealers at a time of market stress when every other major desk was attempting to do the same. It would be an improvement to permit alternative valuation procedures, including good-faith estimates, internal valuations, or replacement value, and this possibility is still under discussion nearly two years after the near-collapse of LTCM.

Widely used netting agreements (such as the ISDA master agreement) have limitations in mitigating risk. Netting arrangements can reduce the credit exposures on a large number of transactions between two counterparties to a single net figure. As such they are a risk mitigating technique with significant potential to reduce large gross credit exposures. If netting cannot be relied upon as legally enforceable, the hint of default can trigger the unwinding of gross exposures. The failure to recognize this possibility may be a source of misperceptions of risk. Several initiatives are currently under way to facilitate bilateral and multilateral netting, but

[18]See Group of Thirty (1993, 1997).

they are typically only for specific instruments (e.g., RepoClear).

Significant uncertainties also exist about the various legal and regulatory environments in which OTC derivatives transactions are conducted, owing to the high pace of innovation, the relatively limited extent of legal precedent, the cross-border nature of OTC derivatives markets, and the supervisory and regulatory framework. Legal risks include the possibilities that a counterparty may "walk away" from obligations or may cherry pick; that it may dispute the terms of an agreement; that it may claim that it did not understand the agreement; and that it may claim that it did not have the authority to enter into the agreement.

In the United States, there is legal ambiguity about whether certain types of swaps are subject to CFTC approval and oversight (see Box 4.7).[19] This has contributed to reluctance to standardize swap contracts and to centralize clearing.[20] Some market participants believe there is also a need to modernize bankruptcy procedures to strengthen the legal certainty of risk mitigation methods and the definitions of what constitutes a default, which is particularly relevant for the development of credit derivatives. For example, some see a need to extend creditor-stay exemptions under U.S. bankruptcy law beyond, for example, swaps and repurchase transactions to other OTC derivatives contracts.

Outside U.S. and U.K. laws, many jurisdictions are ill-suited for effective modern risk management. For example, collateral may afford limited protection in bankruptcy (unless the collateral is held in these two jurisdictions). Legal staffs at major dealer and market-making institutions see significant legal uncertainties associated with the use of collateral in advanced countries (Canada, Italy, and Japan). While the legal and regulatory environments for OTC derivatives are complex in the United States and the United Kingdom, they are considerably more complicated elsewhere. The same instrument might be legally defined as a swap transaction in one country, an insurance contract in a second country, and a pari-mutuel-betting instrument in a third country. Market participants are making strong efforts to mitigate the legal risks, but there are limits to what the private sector can accomplish because contracts must ultimately be enforceable in a legal system.

Strengthening the Stability of Modern Banking and OTC Derivatives Markets

Market participants and officials acknowledge there are problems, if not instabilities, and weaknesses in OTC derivatives markets, and proposals and initiatives have been advanced. Some progress has already been made, and the lessons of recent experience are likely to motivate further actions. However, the available evidence suggests that many recognized problems have yet to be adequately addressed. Insufficient progress has been made in implementing reforms in risk management, including counterparty, liquidity, and operational risks.[21] Relatively less attention has been focused on removing legal and regulatory uncertainty. Given the limited progress to date, it is essential to implement changes to reduce market instability.

Balancing Private and Official Roles

Many of the instabilities identified above can be seen as imperfections in three areas: (1) market discipline, (2) risk mitigating infrastructures, and (3) official rule making and oversight. Aspects of all three failed to prevent the buildup and concentration of counterparty exposures in 1998. Strengthening market stability requires improvements in each of these three areas, but consideration should also be given to altering

[19]See Oakley (2000)

[20]See Folkerts-Landau and Steinherr (1994).

[21]See Counterparty Risk Management Policy Group (1999) and Basel Committee on Banking Supervision (2000a, 2000b).

Box 4.7. Sources of Legal Uncertainty in the U.S. Regulatory Environment

In the United States, legal uncertainties arise from concerns about (1) whether some OTC swap contracts (primarily those that are standardized) could be construed to be futures contracts and would thus be subject to the Commodity Exchange Act and (2) whether certain types of mechanisms for executing and clearing OTC derivatives transactions could alter the status of otherwise exempted or excluded swaps. There are also ambiguities about which securities-based derivatives fall under the jurisdiction of the SEC or CFTC, or may in fact be prohibited.

Uncertainties about the standing of swap agreements emerged in connection with the CFTC's Swap Exemption. The Futures Trading Practices Act of 1992 granted the CFTC authority to exempt certain instruments from the Commodity Exchange Act (and from the requirement to trade on an exchange). In 1993, the CFTC issued the Swap Exemption, which excludes any swap agreement that meets certain criteria from the Commodity Exchange Act. These criteria restrict the design and execution of transactions and are meant to prevent unregulated exchange-like markets for swaps. To qualify for the exemption, a swap (1) must be concluded between eligible swap participants; (2) cannot be standardized as to the material economic terms; (3) cannot be part of a central clearing arrangement; and (4) cannot be traded through a multilateral transaction execution facility.[1] Uncertainties in the interpretation of these conditions have, however, emerged. The rise of electronic trading has blurred the line between bilateral and multilateral trading, and the advantage of centralized clearing systems has become widely recognized as trading volumes have increased and a wider range of users have entered the market.[2] As a result, the limits of the swap exemption have become viewed as impediments to further developing the swaps market and in particular seem to be inhibiting the introduction of electronic trading platforms and clearing arrangements to mitigate risks.

Regulatory uncertainties may have restricted the types of OTC derivatives contracts that are written. Ambiguities about the extent of CFTC or SEC jurisdiction to regulate certain securities-based derivatives, such as equity swaps, credit swaps, and emerging country debt swaps, are largely the legacy of the 1974 amendment of the Commodity Exchange Act that gave the CFTC exclusive jurisdiction over all futures (on physical and financial commodities) without superseding or limiting the jurisdiction of the SEC. But the broad definition of "commodity" in the Commodity Exchange Act raised concerns that OTC markets for government securities and foreign currency would have been covered by the Act. Therefore—upon the Treasury's request—an amendment (the Treasury Amendment of 1974) was inserted into the Act that excluded from it, inter alia, transactions in foreign currency, government securities, and mortgages, "unless such transactions involve the sale thereof for future delivery conducted on a board of trade." However, these amendments did not eliminate conflicts regarding each agency's jurisdiction. Ambiguities and potential overlaps of CFTC and SEC jurisdictions remained, in particular, over novel financial instruments that have elements of securities and futures or commodity option contracts. Therefore, the Shad-Johnson Accord between the SEC and the CFTC was concluded in 1983, which explicitly prohibits futures contracts based on the value of an individual security (other than certain "exempt securities").[3] The Shad-Johnson Accord, however, itself created some uncertainty, particularly about the status of swap agreements that reference "nonexempt securities," such as equity swaps, credit swaps, and emerging market debt swaps.

[1]For a detailed list of these swap conditions, see United States, President's Working Group on Financial Markets (1999).

[2]Folkerts-Landau and Steinherr (1994) and United States, President's Working Group on Financial Markets (1999).

[3]"Exempt securities" include government securities and other securities that are exempt from many of the federal securities laws.

the balance of the roles of the private and public sectors in ensuring market stability, in particular in tilting the balance in the direction of greater reliance on effective market discipline. It is in the general public's interest to have these markets function as smoothly as possible most, if not all, of the time. This raises the more general question: what is the appropriate balance of market discipline on the one hand, and official oversight on the other hand, for ensuring the smooth functioning of OTC derivatives markets?

In striking this balance, several factors are relevant. The authorities in the mature markets, primarily through G-10 efforts, have collectively more or less adopted an approach that places as heavy a reliance on market discipline as is feasible, while recognizing the limits to private discipline, including those emanating from moral hazard, information asymmetries, and other externalities. There is less agreement on the desirable degree of official involvement. Nevertheless, a strong case can be made for relying more heavily on market-disciplining mechanisms provided they can be made more effective. There may also be areas of complementarities and scope for constructive engagement. One such area is disclosure; more voluntary and some involuntary disclosure might go a long way toward improving the effectiveness of risk management and market discipline through greater financial stakeholder awareness. But only the right kind of disclosure would improve matters, and the international community is not clear about the kind or frequency of information that is required. Another consideration is that there are trade-offs. For example, more official oversight or regulation, by creating the impression that officials are monitoring, can create moral hazard by diminishing private stakeholder incentives to monitor and influence business decisions and reduce management incentives for prudent risk taking. Striking the right balance needs to take account of these interrelated effects.

If it is desirable that market discipline carry the heaviest load, it would seem necessary to identify more rigorously the limits (natural or otherwise) that might exist to what the private sector can achieve on its own, against the background of existing rules of the game (supervisory and regulatory frameworks, including financial safety nets). A recent, but by no means unique, example of such a limitation is the private coordination failure that apparently occurred in organizing the private rescue of LTCM. By some accounts, in the days before it became clear that LTCM might default on some of its contracts, several large institutions apparently tried to organize a larger group of institutions to take over the hedge fund. While some were willing to put up substantial amounts of capital, it was in the end insufficient. Moreover, it was also reported that several institutions with financial interests nevertheless decided they would not be a party to such a partnership. This example (of a free-rider problem) represents a limit to the ability of the private sector to ensure the smooth functioning of markets—by coordinating private solutions—in the presence of market stress.

There may also be limits to how far information asymmetries can be reduced. LTCM was widely viewed as a large source of trading revenues and information in 1996 and 1997. Each creditor institution can be viewed as having formulated an investment and trading strategy with LTCM that seemed desirable at the time given the limited information they had. In effect, institutions were involved in a dynamic game with LTCM and within the OTC derivatives markets: they provided financing for LTCM's trades in return for trading activity and a window on LTCM's order flow and investment strategy. Although it is easy, in retrospect, to question why LTCM's counterparts did not demand more information, in a competitive environment, cost considerations must have weighed heavily. Clearly, LTCM's counterparties thought the cost of more information was too high, and walking away from deals was not seen as in their interest. Moreover, they all thought they were receiving useful information from LTCM's orders for trades.

Thus, situations can arise in which institutions in pursuit of self-interest can collectively pro-

duce market conditions that become unsustainable and harmful to them individually and collectively. That is, in the absence of a central, coordinating mechanism that enforces collective self-interest in market stability (such as on an exchange), individually desirable strategies, when aggregated, can produce bad market outcomes. Perhaps private information sharing and coordination could have made the LTCM game end without a severe disruption, but so too could have more effective official refereeing. The challenge is to have a framework that is more effective in preventing these situations from arising, and this involves assigning responsibilities to strengthen areas with potential instabilities.

Strengthening Incentives for More Effective Market Discipline

In some cases the assignment of responsibility is obvious. It is clearly the responsibility of private financial institutions to manage individual private risks, within the regulatory and supervisory framework. Well-known improvements (as discussed above and documented in several reports issued since the LTCM crisis) can be made in risk management and control systems to enhance the likelihood that institutions will remain well capitalized and profitable and thereby help to avoid instability, even in times of stress. The fact that market participants have not moved as quickly as might have been expected to improve risk management systems—given the virulence of the turbulence in the autumn of 1998—suggests that designing and implementing new systems to deal with the complex and evolving risks involved in OTC derivatives is a difficult challenge. On the other hand, while institutions have been slow to move ahead quickly with changes in risk management, there nevertheless is evidence that some of the major institutions are presently devoting less capital to market-making in OTC derivatives markets and have also reduced proprietary trading.

Moral hazard, perhaps associated with national histories of market interventions, may be another factor impinging on the effectiveness of market discipline. The risk to financial stability arising from banks' OTC derivatives activities may also be influenced by access to financial safety nets, which by imparting a subsidy element can influence the pricing of risk and thereby lead to overextensions of credit both on- and off-balance-sheet. Access to safety nets (including central bank financing) can give rise to incentives to take additional risks that can lead to the buildup of large, leveraged exposures, which, when suddenly unwound, can precipitate a financial crisis of systemic proportions. Moreover, interventions during one stressful episode that limit losses can sow the seeds of the next buildup of exposures. These influences may have dampened the strong potential signal that institutions might have received from the turbulence that followed the near-collapse of LTCM.

It may be time to consider incentives that might be provided by the official sector to encourage the private sector to improve its ability to monitor itself, and to improve the effectiveness of market discipline. As emphasized in last year's report,[22] one way of improving the ability of private incentives to effectively discipline behavior is for the private and public sectors to jointly identify possible inconsistencies arising from the complex interplay of both private and regulatory incentives as they affect private decisions. Inconsistencies between private and regulatory incentives—for example, inconsistencies between internal models for allocating capital and regulatory capital requirements—could thus be rectified to alter behavior in ways that preserve efficiency and promote market stability.

Reducing Legal and Regulatory Uncertainty

There also seems to be an obvious assignment of responsibilities in the area of legal and regulatory uncertainty. The official sector and national

[22]See p. 79 in IMF (1999).

legislatures can reduce legal and regulatory uncertainty. Legal or regulatory uncertainties that can be clearly identified should be addressed as soon as possible. Three areas immediately come to mind: the regulatory treatment of swaps and the implications for using private clearinghouses; closeout procedures; and netting. In each of these cases, reducing uncertainty could have the adverse consequence of actually increasing risk taking. To ensure that measures to reduce legal and regulatory uncertainty actually strengthen financial stability, it may be desirable, therefore, to link them to measures to address those features of OTC derivatives, institutions, and markets that most clearly pose risks to market stability. For example, legal certainty of closeout and netting would implicitly provide OTC derivatives creditors seniority over general creditors if a counterparty defaults. This could give rise to incentives to engage in riskier activities. To counteract such incentives, the extent of legally sanctioned closeout of contracts and permitted netting of exposures could be made contingent on key structural reforms that enhance stability. In this example, trading arrangements along the lines of a clearinghouse could be treated more favorably with respect to closeout and/or netting. More generally, the public sector should consider how steps to strengthen the legal infrastructure could help promote structural improvements in OTC derivatives markets. With these provisos in mind, the following considerations could potentially reduce the risk of market instability.

First, in the United States, the agencies supervising institutions and regulating markets (including the Federal Reserve System, the Treasury, the SEC, and the CFTC) agree that financial swaps ought to be exempt from CFTC supervision and regulation. The recent report by the President's Working Group on Financial Markets on regulation of OTC derivatives recommended removing this uncertainty through legislative reforms that would grant swaps an exemption from potential CFTC oversight.[23] This has been well received by the private sector, and work is under way, but limited progress has been made in this area. Resolving this issue with changes in legislation would clear the way for serious private consideration of reorganizing OTC derivatives markets, including taking advantage of many of the risk-mitigating possibilities of a clearinghouse structure. Although legislation is under consideration in the U.S. Congress, some concerns have been expressed by the U.S. Federal Reserve Board, the U.S. Treasury, and the U.S. SEC about some features of this legislation, and it remains to be seen if the necessary changes will be passed into U.S. law.[24]

If the legal obstacles to a clearinghouse for OTC derivatives are removed, such an arrangement could mitigate risks associated with plain-vanilla swaps by handling clearing and settlement, formalizing and standardizing the management of counterparty risk through margin, and mutualizing the risk of counterparty default, and thereby could reinforce market discipline and encourage self-regulation.[25] Another question is whether market participants would need official encouragement to use a private clearinghouse. On the one hand, some market participants have expressed considerable skepticism about such an arrangement, and the clearing arrangements attempted thus far (such as SwapClear) have attracted little activity, in part because they are perceived to be costly, including relating to regulatory capital requirements. On the other hand, some market participants see a central clearinghouse as inevitable in view of the considerable operational difficulties of managing an OTC derivatives business, the challenges of managing credit risk on a bilateral ba-

[23]See United States, President's Working Group on Financial Markets (1999).

[24]See testimony by Federal Reserve Chairman Greenspan, SEC Chairman Levitt, and Treasury Secretary Summers before the Joint U.S. Senate Committees on Agriculture, Nutrition, and Forestry and on Banking, Housing, and Urban Affairs on June 21, 2000.

[25]For discussions of issues surrounding clearinghouses, see Hills and others (1999); Hills and Rule (1999), pp. 111–12; and Bank of England (2000), pp. 77–78.

sis, and the legal uncertainty of the OTC environment. In any case, if the regulatory environment is liberalized and the legal environment is clarified, this could accelerate the adoption of private electronic trading arrangements for swaps and other OTC derivatives (already in evidence in 2000) and may well give rise to de facto private clearinghouses.

Second, closeout procedures for derivative contracts have proven to be impractical and ineffective in some jurisdictions and under some market circumstances. Had they worked effectively, some of the adverse market dynamics in the LTCM crises might have been avoided. The uncertainty of their applicability might be clarified by the appropriate regulatory and legal bodies, including at the G-10 level if they involve more than one legal jurisdiction. The consequences of inaction could mean that virulent dynamics will not be avoided the next time there are rumors of default in OTC derivatives markets.

Third, netting arrangements are another risk mitigation technique that can help reduce gross creditor and debtor counterparty positions to a single bilateral credit or debit with each counterparty. The uncertainty about the legality and regulatory treatment of these arrangements can give rise to situations of heightened credit risk. Further and stronger efforts should be made to strengthen the legal basis for netting.

Coordinated Improvements in Disclosure

Coordination is particularly necessary in the area of information disclosure. In finance, information is a source of economic rents. There are natural limits to how much of it will be voluntarily provided publicly, or even privately to establish counterparty relationships. Therefore, the private sector is unlikely, on its own accord, to provide the right amount and kind of information to counterparties, the markets, and authorities, unless it has incentives to do so. Accounting standards and prudential rules require certain forms of disclosure. However, there was insufficient information in 1998 for private counterparts, supervisors, or those responsible for market surveillance to reach the judgment that vulnerabilities were growing in the global financial system. The public sector has a strong role to play in providing incentives for greater disclosure to the markets and greater information on a confidential basis to the official sector.

While, in principle, creditors have incentives to demand adequate disclosure from their counterparties, these can be undermined by competitive pressures and concerns by their counterparties that confidentiality might not be protected. To overcome this, emphasis can be placed on strengthening the primacy of credit risk management, including the autonomy of risk management within organizations to make confidentiality credible, in line with proposals by both private and official groups. The public sector role could be limited to assessing and monitoring the quality of risk management and control systems more systematically and thoroughly, including how information is utilized, and also to ensuring that counterparty disclosure is adequate. The counterparty market discipline imposed by creditors could also be strengthened significantly through better pricing and control of the terms of access to credit.

The challenges in improving public disclosure are formidable. The shift in the boundary between private and public information could, by reducing the private information advantage, lessen intermediation activity. The potential consequences for market functioning need to be weighed against the benefits for market participants from more information on risk concentrations. In addition, it will be difficult to guarantee confidentiality, and even more difficult to develop a consensus on what can usefully be disclosed, in what form, to whom, and how often. For these reasons, an eclectic, innovative approach is needed to address these challenges and pitfalls. Supervisors might promote and facilitate more exchange-like OTC market structures, such as clearinghouses and electronic trading and settlement systems, which would support greater transparency and potentially serve as a nexus for information. Supervisors and regulators could facilitate the adoption of

such facilities by regulating them lightly and by devising arrangements for multilateral clearing of contracts that are already covered under bilateral master agreements. Addressing this challenge requires close cooperation between public and private sectors to strike the right balance between financial market efficiency and stability.

Private and Public Roles in Reducing Systemic Risk

In the area of systemic risk, it is important that both the private and the public sector work to reduce it. Private market participants can—by developing and implementing effective risk management and control systems and risk mitigation tools—individually ensure their own viability and soundness even in extreme circumstances. As noted in last year's *International Capital Markets* report, well-managed and highly capitalized financial institutions are important components of the first lines of defense against systemic financial problems. Improved risk management and control would reduce the potential for excessive risk taking and the buildup of vulnerabilities at individual institutions, and highly capitalized institutions are better able to absorb losses when they occur. If all institutions succeeded in accomplishing these objectives, the effectiveness of the first line of defense against systemic risk—market discipline—would be strengthened. Under the presumption that a chain is only as strong as its weakest link, unless all of the systemically important financial institutions substantially improve their risk management systems, no financial institution can be assured of dealing in OTC derivatives markets with counterparties that are managing their risks well. Thus, there is some—albeit not a strong—incentive for collective private action centered around improving risk management and the financial infrastructure of these systemically important markets. Such collective private action would support the efforts of industry groups such as ISDA, the Group of Thirty, and more recently the Corrigan and Thieke Group.[26] These efforts should be intensified and accelerated.

In addition to private actions to reduce systemic risk, authorities are responsible for ensuring financial stability, including through prudential regulations, banking supervision, and market surveillance. Regarding prudential regulations, one strong step forward would be for the Basel Committee on Banking Supervision to reconsider capital requirements for off-balance-sheet credit risks. While the Committee's recent proposals go some way toward more effectively recognizing the risks in off-balance-sheet activities, the increasing sophistication of banks in arbitraging capital requirements and the dynamic nature of OTC derivatives exposures is likely to widen existing gaps in the measurement of banks' overall credit exposures, and consequently in setting appropriate capital levels. The Committee should give consideration to ways in which capital charges on OTC derivatives positions could more closely reflect the significant changes (positive and negative) that occur in a bank's current and potential future credit exposures when market prices change. In this context, banks' internal credit risk systems could be required to quantify off-balance-sheet credit exposures (both current and potential) as a basis for appropriate capital charges—subject to verification through effective supervision.

More generally, authorities face the difficult challenge of helping to ensure financial stability without encouraging risk taking beyond some reasonable prudent level, without impeding financial innovations, and without unduly distorting market incentives. In principle, safeguards (including parts of the financial safety net) promote a more desirable equilibrium than would be obtained without them. But the safeguards may also encourage excessive risk taking. The challenge of keeping moral hazard to a bare minimum in the first instance requires the authorities to engage in sufficient monitoring to ensure that the insured institutions and markets

[26]See pp. 77–79 and 173–75 of IMF (1999).

take appropriate account of the risks entailed in their activities. This means that banking supervision and market surveillance need to keep abreast of the changing financial landscape and the institutions that change it, and also need to invest in developing analytical frameworks for understanding them.

Glossary List

Book value: The value of an asset that appears on a balance sheet based on historic cost or the original purchase price.

Broker: An intermediary between buyers and sellers that acts in a transaction as an agent, rather than a principal, charges a commission or fee, and—unlike a dealer—does not buy or sell for its own account or make markets. In some jurisdictions, the term "broker" also refers to the specific legal or regulatory status of institutions performing this function.

Clearing and settlement: The process of matching parties in a transaction according to the terms of a contract, and the fulfillment of obligations (for example, through the exchange of securities or funds).

Clearinghouse: An entity, typically affiliated with a futures or options exchange, that clears trades through delivery of the commodity or purchase of offsetting futures positions and serves as a central counterparty. It may also hold performance bonds posted by dealers to ensure fulfillment of futures and options obligations.

Closeout procedures: Steps taken by a nondefaulting party to terminate a contract prior to its maturity when the other party fails to perform according to the contract's terms.

Collateral: Assets pledged as security to ensure payment or performance of an obligation.

Credit exposure: The present value of the amount receivable or payable on a contract, consisting of the sum of current exposure and potential future exposure.

Creditor stay exemption: The exclusion of certain creditors from the automatic stay provision of the bankruptcy code, which generally limits creditors' capacity to directly collect debts owed by a bankrupt party, including through netting of outstanding contracts. An example is the U.S. Bankruptcy Code statutory exceptions for repurchase agreements, securities contracts, commodity contracts, swap agreements, and forward contracts, where counterparties can close out exempt OTC derivatives positions outside of bankruptcy procedures.

Credit risk: The risk associated with the possibility that a borrower will be unwilling or unable to fulfill its contractual obligations, thereby causing the holder of the claim to suffer a loss.

Dealer: An intermediary that acts as a principal in a transaction, buys (or sells) on its own account, and thus takes positions and risks. It earns profit from bid-ask spreads. A dealer can be distinguished from a broker, who acts only as an agent for customers and charges commission. In some jurisdictions, the term "dealer" also refers to the specific legal or regulatory status of institutions performing this function.

Derivatives (exchange-traded and OTC): Financial contracts whose value derives from underlying securities prices, interest rates, foreign exchange rates, market indexes, or commodity prices. Exchange-traded derivatives are standardized products traded on the floor of an organized exchange and usually require a good faith deposit, or margin, when buying or selling a contract. OTC derivatives, such as currency swaps and interest rate swaps, are privately negotiated bilateral agreements transacted off organized exchanges.

Forward contract: A contractual obligation between two parties to exchange a particular good or instrument at a set price on a future date. The buyer of the forward agrees to pay the price and take delivery of the good or instrument and is said to be "long the forward," while the seller of the forward agrees to deliver the good or instrument at the agreed price on the agreed date.

Collateral may be deposited, but cash is not exchanged until the delivery date. Forward contracts, unlike futures, are not traded on organized exchanges.

Futures: A negotiable contract to make or take delivery of a standardized amount of a commodity or securities at a specific date for an agreed price, under terms and conditions established by a regulated futures exchange where trading takes place. It is essentially a standardized forward contract that is traded on an organized exchange and subject to the requirements defined by the exchange.

Haircut: The difference between the amount advanced by a lender and the market value of collateral securing the loan. For example, if a lender makes a loan equal to 90 percent of the value of marketable securities that are provided as collateral, the difference (10 percent) is the haircut.

Hedging: The process of offsetting an existing risk exposure by taking an opposite position in the same or a similar risk, for example, through purchasing derivatives.

Intermediation: The process of transferring funds from an ultimate source to the ultimate user. A financial institution, such as a bank, intermediates credit when it obtains money from a depositor and relends it to a borrowing customer.

Legal risk: Risks that arise when a counterparty might not have the legal or regulatory authority to engage in a transaction or when the law may not perform as expected. Legal risks also include compliance and regulatory risks, which concern activities that might breach government regulations, such as market manipulation, insider trading, and suitability restrictions.

Leverage: The magnification of the rate of return (positive and negative) on a position or investment beyond the rate obtained by direct investment of own funds in the cash market. It is often measured as the ratio of on- and off-balance-sheet exposures to capital. Leverage can be built up by borrowing (on-balance-sheet leverage, commonly measured by debt-to-equity ratios) or through the use of off-balance-sheet transactions.

Liquidity: The ability to raise cash easily and with minimal delay. Market liquidity is the ability to transact business in necessary volumes without unduly moving market prices. Funding liquidity is the ability of an entity to fund its positions and meet, when due, the cash and collateral demands of counterparties, credit providers, and investors.

Margin: The amount of cash or eligible collateral an investor must deposit with a counterparty or intermediary when conducting a transaction. For example, when buying or selling a futures contract, it is the amount that must be deposited with a broker or clearinghouse. If the futures price moves adversely, the investor might receive a margin call—that is, a demand for additional funds or collateral (variation margin) to offset position losses in the margin account.

Mark-to-market: The valuation of a position or portfolio by reference to the most recent price at which a financial instrument can be bought or sold in normal volumes. The mark-to-market value might equal the current market value—as opposed to historic accounting or book value—or the present value of expected future cash flows.

Market-maker: An intermediary that holds an inventory of financial instruments (or risk positions) and stands ready to execute buy and sell orders on behalf of customers at posted prices or on its own account. The market-maker assumes risk by taking possession of the asset or position. In organized exchanges, market-makers are licensed by a regulating body or by the exchange itself.

Market risk: The risk that arises from possible changes in the prices of financial assets and liabilities; it is typically measured by price volatility.

Master agreement: Comprehensive documentation of standard contractual terms and conditions that covers a range of OTC derivatives transactions between two counterparties.

Moral hazard: Actions of economic agents that are to their own benefits but to the detriment of others and arise when incomplete information or incomplete contracts prevent the full assignment of damages (and/or benefits) to the agent responsible. For example, under asymmetric information, borrowers may have incentives to engage in riskier activities that may be to their advantage, but which harm the lender by increasing the risk of default.

Netting arrangement: A written contract to combine offsetting obligations between two or more parties to reduce them to a single net payment or receipt for each party. For example, two banks owing each other $10 million and $12 million, respectively, might agree to value their mutual obligation at $2 million (the net difference between $10 million and $12 million) for accounting purposes. Netting can be done bilaterally—when two parties settle contracts at net value—as is standard practice under a master agreement, or multilaterally through a clearinghouse. Closeout netting combines offsetting credit exposures between two parties when a contract is terminated.

Notional amount/principal: The reference value (which is typically not exchanged) on which the cash flows of a derivatives contract are based. For example, the notional principal underlying a swap transaction is used to compute swap payments in an interest rate swap or currency swap.

Off-balance-sheet items: Financial commitments that do not involve booking assets or liabilities, and thus do not appear on the balance sheet.

Operational risk: Risk of losses resulting from management failure, faulty internal controls, fraud, or human error. It includes execution risk, which encompasses situations where trades fail to be executed, or more generally, any problem in back-office operations.

Option: A contract granting the right, and not the obligation, to purchase or sell an asset during a specified period at an agreed-upon price (the exercise price or strike price). A call option is a contract that gives the holder the right to buy from the option seller an asset at a specified price; a put option is a contract that gives the holder the right to sell an asset at a predetermined price. Options are traded both on exchanges and over the counter.

Over-the-counter (OTC) market: A market for securities where trading is not conducted in an organized exchange but through bilateral negotiations. Often these markets are intermediated by brokers and/or dealers. Examples of OTC derivatives transactions include foreign exchange forward contracts, currency swaps, and interest rate swaps.

Performance bonds: Bonds that provide specific monetary payments if a counterparty fails to fulfill a contract, thereby providing protection against loss in the event the terms of a contract are violated.

Potential future exposure (PFE): The amount potentially at risk over the term of a derivatives contract if a counterparty defaults. It varies over time in response to the perceived risk of asset price movements that can affect the value of the exposure.

Replacement value/cost: The current exposure adjusted to reflect the cost of replacing a defaulted contract.

Swap: A derivatives contract that involves a series of exchanges of payments. Examples are agreements to exchange interest payments in a fixed-rate obligation for interest payments in a floating-rate obligation (an interest rate swap), or one currency for another (a foreign exchange swap) and reverse the exchange at a later date. A cross-currency interest rate swap is the exchange of a fixed-rate obligation in one currency for a floating-rate obligation in another currency.

Value at Risk (VaR): A statistical estimate of the potential mark-to-market loss to a trading position or portfolio from an adverse market move over a given time horizon. VaR reflects a selected confidence level, so actual losses during a period

are not expected to exceed the estimate more than a pre-specified number of times.

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