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Derivatives in Financial Market Development

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Executive Summary

Derivatives are financial instruments whose payoffs derive from other, more primitive financial variables such as a stock price, a commodity price, an index level, an interest rate, or an exchange rate. The world market for derivatives is an immense one. The notion amount outstanding in the over-the-counter (OTC) derivatives market worldwide exceeds $640 *trillion*, with a collective gross market value of over $27 trillion. The exchange-traded market has another $60 trillion in outstanding notional. The growth of derivatives usage over the last two decades has been rapid in both advanced economies and emerging markets; in both OTC contracts and those that are exchange-traded; and across all underlying classes, including interest-rate, currency, equity, and the most recent addition, credit.

Derivatives are enormously useful instruments in the management of risk. They can be used to hedge an existing market exposure (forwards and futures), to obtain downside protection to an exposure even while retaining upside potential (options), to transform the nature of an exposure (swaps), and to obtain insurance against events such as default (credit derivatives). For corporations and financial institutions looking to manage exchange-rate risk, input costs, financing costs, or credit exposures, these are invaluable features, and explain to a considerable extent the rapid growth of the derivatives market as globalization and global interlinkages have grown.

Derivatives are also highly levered instruments, and this has its own implications. On the one hand, the leverage makes derivatives attractive to speculators (those who wish to bet on price direction). In itself, this is not a bad thing, since speculators add considerable liquidity to the market and, by taking the opposite side, facilitate the positions hedgers want to take. However, leverage magnifies the effect of price moves, so sharp unfavorable price moves can easily spell disaster to the derivatives portfolio and thence to the larger business entity. Indeed, the annals of financial history are littered with stories of corporations and financial institutions which collapsed when a deterioration in market conditions led to massive losses in the derivatives portfolio—occasionally, even in cases where the derivatives were being used to hedge existing exposures. The potentially lethal cocktail of leverage and volatility makes it vital that users understand fully the risks of the instruments, and regulators the systemic impact of volatility spikes.

India's derivatives markets, both OTC and exchange-traded, have seen rapid growth over the last decade, and with relatively few sputters. The successes are visible and real—several Indian exchanges rank among the world's top exchanges in terms of number of derivatives contracts traded (though the figures are exaggerated by the small size of Indian contracts compared to the

major international exchanges); and there have been no large scale derivatives disasters of the sort that have roiled the advanced economies. But problems lurk not far beneath the surface. Many underlying markets are illiquid and lack depth, simultaneously increasing the need for alternative risk-management tools and hampering the development of the corresponding derivatives markets. Anecdotal evidence suggests too that Indian exchanges may be losing volumes to overseas competitors because of regulatory burdens. The challenge in this environment is to find a way to sustain the growth and deepen the market, making tools of risk-management more widely available to corporates and banks, even while avoiding speculative excesses.

In this context, the recent Dodd-Frank reforms in the US offer a useful framework for thinking about issues. The Dodd-Frank Act has as its objectives the minimization of systemic risk from derivatives use and increasing the transparency of the OTC derivatives market. Towards these ends, the Act has mandated, among other things, that those OTC derivatives that are sufficiently standardized to move to trading on "swap exchange facilities," essentially exchanges. On the one hand, this will bring in exchange-like transparency and reduction of counterparty risk; on the other hand, the exchanges created in this fashion will truly be too big to fail, making the monitoring of the exchange a key regulatory challenge. The Act also contains provisions—the Lincoln Rule and the Volcker Rule—designed to discourage banks from speculative derivatives trading. Again, this provision cuts both ways. In principle, it could make banks safer. On the other hand, it could also result in the banks' trading operations being spun off into separate entities, meaning that derivatives trading would move from regulated entities to unregulated ones. There are, unfortunately, no simple answers.

1 Introduction

This note discusses the role of derivatives in financial markets and their development. The presentation is in several parts.

Section 2 lays the basis. It describes the size, composition, and evolution of the world's derivative markets; and discusses the key differences between derivatives markets in advanced economies and those in emerging markets. For those unfamiliar with derivative securities, Appendix A defines the instruments and their characteristics in some detail.

Sections 3 and 4 build on this foundation in two directions. The former looks at the positive side of derivatives, at the ways in which derivatives may be used by individuals, corporations and other entities to mitigate or manage risk. In essence, it addresses the question: what (good) can we do with derivatives that would be impossible in the absence of derivatives? Section 4 looks at the flip side of these benefits, the risks that come with derivatives use, particularly the potentially lethal leverage-volatility combination that accompanies derivatives. Several important case studies are presented that highlight these risks.

Section 5 discusses derivatives markets in the Indian context, and offers some comments on the developments here, positive and negative. Section 6 concludes with a look at regulatory challenges and recent developments, with a particular focus on the Dodd-Frank Act in the US.

2 The World Derivatives Market

A *derivative security* is a financial security whose payoff depends on (or *derives from*) a more fundamental underlying financial variable such as a commodity price, a stock price, an exchange rate, an interest rate, an index level—or even the price of another derivative security. Derivatives have become ubiquitous in today's financial world with thriving exchanges in nearly every major country and a huge over-the-counter market. In this introductory segment, we describe the major classes of derivatives, and present data on the size and growth of the market and its constituent parts.

2.1 Basic Derivative Instruments

The three basic kinds of derivative securities are *forwards and futures; swaps;* and *options*. We begin with brief descriptions of each of these, as also of the relatively recent innovation of credit derivatives, particularly *credit default swaps*. A more detailed description of these instruments

and their characteristics may be found in Appendix A.

Forwards A forward contract is one in which two parties (referred to as the "counterparties" to the transaction) commit to the terms of a specified trade to be carried out on a specified date in the future. Forward contracts are bilateral or "over the counter" (OTC) contracts, i.e., they are negotiated directly between buyer and seller. On the positive side, this means they are customizable in terms of the maturity date, the specific quality (grade) to be delivered, etc. On the other hand, each party also takes on the risk of the other counterparty's default.

Futures A futures contract is, in essence, a forward contract that is traded on an organized exchange rather than negotiated bilaterally. Futures contracts grew out of forward contracts in the mid-19th century. Futures contract terms (maturity dates, deliverable grade of the underlying, etc.) are standardized, and the exchange guarantees performance on the contract. Participants in futures markets are required to post "margin," which is essentially collateral against default.

Swaps Swaps, like forwards, are over-the-counter contracts. In a forward, the two counterparties commit to a single trade or single exchange of cash flows. In a swap, the counterparties commit to multiple exchanges of cash flows over several dates in the future.[1] Swaps are most common in the interest-rate derivatives market, where the typical contract has the parties exchanging one interest index for another computed on a given notional principal amount. (For example, one counterparty in the swap may make floating-rate payments indexed to Libor, while the other makes fixed-rate payments on the same principal amount.) They are also popular in the currency market, where the swap involves an exchange of principal and currency in one exchange for principal and currency in another.

Options An option is a financial security that gives the holder the right, but not the obligation, to take part in a specified trade. There are two basic kinds of options (and a great many variants on these structures). In a *call* option, the holder of the option has the right, but not the obligation, to *buy* the specified underlying asset at a price specified in the contract (called the "strike price"). In a *put* option, the holder of the option has the right to *sell* the underlying asset at the specified strike price.

The holder of the option is also variously referred to as the long position in the option or the buyer of the option. The other counterparty in option trade—who has an obligation to take part in the trade if the option buyer should decide to exercise his right—is called the *seller* or *writer* of

[1] Swaps may also sometimes involve just a single exchange of cash flows. For example, the natural gas swap contract cleared on the InterContinental Exchange's ICE OTC is essentially a cash-settled futures contract.

the option or the *short position* in the option. In exchange for providing the option holder with optionality concerning the trade, the option writer receives an up-front fee called the *option price* or the *option premium*.

Options trade both on organized exchanges and in the over-the-counter (OTC) market. Exchange-traded options exist on equities, equity indices, currencies, and interest rates and bonds, among others. Exchange-traded options are standardized in terms of expiry dates and strike prices. OTC options are customizable and exhibit a great deal more variety.

Credit Derivatives Credit derivatives are derivatives written on the credit risk of an underlying reference entity. By far the most popular form of credit derivative is the credit default swap or CDS. Akin to insurance against default, a CDS references a specific credit obligation issued by a specified entity (for example, a specific bond issued by Ford Motor Company). One counterparty in the CDS contract (the "buyer of protection") makes a regular periodic payment to the other counterparty (the "seller of protection"); in exchange the protection seller agrees to pay the protection buyer any loss in value on the specified reference obligation if a "credit event" (e.g., default) were to occur during the life of the CDS contract.

CDS indices are indices created from CDS prices in a manner similar to the creation of equity indices out of equity prices. There are two major families of credit indices, the iTraxx indices which cover Europe, and the CDX indices which cover North America and Asia. About three-quarters of the credit derivatives market is composed of trading in CDSs and the CDS indices.

2.2 Market Size and Growth

Tables 1-3 describe the size and growth of the world derivatives market. Tables 1 and 2 deal with over-the-counter derivatives market (derivatives that are negotiated bilaterally), while Table 3 looks at exchange-traded derivatives (i.e., standardized derivatives traded on organized exchanges). Within each table, the information is further subdivided first by underlying and then by instrument-type. The data in all cases is from the Bank for International Settlements (BIS).

Derivatives markets are immense in size. As of December 2011, the total notional outstanding[2]

[2]Notional outstanding refers, loosely speaking, to the principal amount of the contracts. For example, if a forward contract calls for the delivery of 1,000 oz of gold at a price of \$1,800/oz, the notional outstanding in the contract is $\$(1,800 \times 1,000) = \$1.80$ million. If an option gives the holder the right to buy 10,000 shares of Google at \$500/ share, the notional outstanding in the contract is $\$(10,000 \times 500) = \$5$ million. If a swap calls for the exchange of floating cash flows for fixed cash flows on a principal of \$100 million, the notional outstanding in the swap is \$100 million. And so on.

Table 1: The OTC Derivatives Market I: 2007-2011

	Notional amounts outstanding			Gross market values		
	Dec.2007	Dec.2009	Dec.2011	Dec.2007	Dec.2009	Dec.2011
Total contracts	**585,932**	**603,900**	**647,762**	**15,802**	**21,542**	**27,285**
FX contracts	**56,238**	**49,181**	**63,349**	**1,807**	**2,070**	**2,555**
Forwards and forex swaps	29,144	23,129	30,526	675	683	919
Currency swaps	14,347	16,509	22,791	817	1,043	1,318
Options	12,748	9,543	10,032	315	344	318
Interest rate contracts	**393,138**	**449,875**	**504,098**	**7,177**	**14,020**	**20,001**
Forward rate agreements	26,599	51,779	50,576	41	80	67
Interest rate swaps	309,588	349,288	402,611	6,183	12,576	18,046
Options	56,951	48,808	50,911	953	1,364	1,888
Equity-linked contracts	**8,469**	**5,937**	**5,982**	**1,142**	**708**	**679**
Forwards and swaps	2,233	1,652	1,738	239	176	156
Options	6,236	4,285	4,244	903	532	523
Commodity contracts	**8,455**	**2,944**	**3,091**	**1,898**	**545**	**487**
Gold	595	423	521	70	48	82
Other commodities	7,861	2,521	2,570	1,829	497	405
Credit default swaps	**58,244**	**32,693**	**28,633**	**2,020**	**1,801**	**1,586**
Single-name instruments	32,486	21,917	16,881	1,158	1,243	962
Multi-name instruments	25,757	10,776	11,752	862	558	624
Unallocated	61,387	63,270	42,606	1,759	2,398	1,977

All figures in USD billions.

Source: The Bank for International Settlements, http://www.bis.org.

in the OTC derivatives market was $648 trillion, representing a gross market value[3] of $27 trillion. By way of comparison, total world equity market capitalization in December 2011 was of the order of around $47 trillion, the world bond markets amounted to around $95 trillion in face value, and world GDP in 2011 was estimated to be around $65 trillion.

The tables reveal that interest-rate derivatives—derivatives written on interest rates or on interest-rate sensitive securities such as bonds—have throughout been by far the most dominant class of derivatives in the OTC market, accounting for over 70% of the total notional outstanding (over $500 trillion by December 2011). Currency derivatives are the second largest chunk of the market measured by notional outstanding, accounting for over $63 trillion in December 2011, while OTC equity derivatives had a notional outstanding of almost $6 trillion, down from a high of nearly $8.50 trillion in December 2007. Particularly noteworthy is the growth of the credit

[3]Gross market value is defined as the sum of the absolute replacement value of all outstanding contracts. For example, consider a call option contract on Google that gives the holder the right to buy 10,000 shares of Google at $500 per share. If the market call premium (i.e., the price of each call option in the market) is $35, the market value of the contract is $\$(10,000 \times 35) = \$350{,}000$.

Table 2: The OTC Derivatives Market II: 1998-2011

	Dec.1998	Dec.2001	Dec.2004	Dec.2007	Dec.2008	Dec.2009	Dec.2010	Dec.2011
Total contracts	**80,309**	**111,178**	**258,628**	**585,932**	**598,147**	**603,900**	**601,046**	**647,762**
FX Contracts	**18,011**	**16,748**	**29,289**	**56,238**	**50,042**	**49,181**	**57,796**	**63,349**
Forwards/FX swaps	12,063	10,336	14,951	29,144	24,494	23,129	28,433	30,526
Currency swaps	2,253	3,942	8,223	14,347	14,941	16,509	19,271	22,791
Options	3,695	2,470	6,115	12,748	10,608	9,543	10,092	10,032
Interest rate contracts	**50,015**	**77,568**	**190,502**	**393,138**	**432,657**	**449,875**	**465,260**	**504,098**
Forward rate agreements	5,756	7,737	12,789	26,599	41,561	51,779	51,587	50,576
Interest rate swaps	36,262	58,897	150,631	309,588	341,128	349,288	364,377	402,611
Options	7,997	10,933	27,082	56,951	49,968	48,808	49,295	50,911
Equity-linked contracts	**1,488**	**1,881**	**4,385**	**8,469**	**6,471**	**5,937**	**5,635**	**5,982**
Forwards and swaps	146	320	756	2,233	1,627	1,652	1,828	1,738
Options	1,342	1,561	3,629	6,236	4,844	4,285	3,807	4,244
Commodity contracts	**408**	**598**	**1,443**	**8,455**	**4,427**	**2,944**	**2,922**	**3,091**
Gold	175	231	369	595	395	423	397	521
Other commodities	233	367	1,074	7,861	4,032	2,521	2,525	2,570
Forwards and swaps	137	217	558	5,085	2,471	1,675	1,781	1,745
Options	97	150	516	2,776	1,561	846	744	825
Credit default swaps			**6,396**	**58,244**	**41,883**	**32,693**	**29,898**	**28,633**
Single-name instruments			5,117	32,486	25,740	21,917	18,145	16,881
Multi-name instruments			1,279	25,757	16,143	10,776	11,753	11,752
of which index products							7,476	10,466
Unallocated	10,387	14,384	26,613	61,387	62,667	63,270	39,536	42,606

Amounts in table refer to notional outstanding. All figures in USD billions.
Source: The Bank for International Settlements, http://www.bis.org.

derivatives segment. Literally non-existent twenty years ago, credit derivatives have a notional outstanding approaching $30 trillion, making them on that measure the third largest segment of the OTC derivatives market today.

Table 2 shows that the OTC derivatives market has been growing very rapidly over the last decade and a half, slowing down only with the onset of the financial crisis in 2007-08. The market-wide notional outstanding in December 2011 was more than 8 times the amount in December 1998, a compound annual growth rate exceeding 17%. Every segment of the market experienced substantial growth over this period, with interest rate derivatives growing tenfold, commodity derivatives eightfold, and equity derivatives fourfold.[4]

Table 3 describes total notional outstanding on the world's derivatives exchanges. As of December 2011, the figure stood at $58 trillion ($23 trillion in futures and $35 trillion in options),

[4]Tables 1 and 2 do not fully reflect the diversity of the OTC derivatives market. Derivatives are today written on a range of once-exotic underlying variables including electricity prices, temperature levels, broadband, newsprint, and market volatility, among others. Many of these (e.g., electricity derivatives) have become important niche products, allowing firms operating in that sector to hedge their risks.

Table 3: The Exchange-Traded Derivatives Market: 1998-2011

	Dec.1998	Dec.2001	Dec.2004	Dec.2007	Dec.2008	Dec.2009	Dec.2010	Dec.2011
Futures	**8,355**	**9,675**	**18,902**	**28,051**	**19,508**	**21,738**	**22,312**	**22,930**
Interest rate	8,031	9,270	18,165	26,770	18,732	20,628	21,013	21,724
Currency	32	73	114	180	125	144	170	221
Equity index	291	332	624	1,101	651	966	1,128	985
North America	3,527	5,909	10,459	14,469	10,138	10,721	11,864	13,107
Europe	2,894	2,437	5,972	9,013	6,507	8,054	6,345	6,534
Asia and Pacific	1,677	1,240	2,290	3,942	2,466	2,408	3,169	2,344
Other Markets	257	88	181	627	397	555	935	945
Options	**5,620**	**14,081**	**27,619**	**51,037**	**38,236**	**51,380**	**45,635**	**35,402**
Interest rate	4,623	12,493	24,604	44,282	33,979	46,429	40,930	31,581
Currency	49	27	61	133	129	147	144	88
Equity index	948	1,561	2,954	6,622	4,128	4,804	4,560	3,733
North America	3,868	10,278	17,073	28,024	19,533	23,875	24,353	19,786
Europe	1,503	3,704	10,336	21,554	18,116	26,323	19,247	14,285
Asia and Pacific	205	68	133	1,021	219	310	383	350
Other Markets	44	31	77	438	368	872	1,651	982

Amounts in table refer to notional outstanding. All figures in USD billions.
Source: The Bank for International Settlements, http://www.bis.org.

down from a peak of $79 trillion in December 2007.[5] The notional outstanding figures in futures markets too are dominated by interest-rate derivatives, indeed even more so than OTC markets, accounting for around 90% of the total. Equities constitute the second largest segment, with the currency market representing a relatively small share. As with OTC markets, derivatives growth on exchanges was rapid in the early years of the 2000s, with the market growing more than fivefold in the years from 1998-2007. Despite the fall in the market size since then, the market shows a compound annual growth rate in the 1998-2011 period comfortably exceeding 11%.

2.3 Emerging Markets versus Advanced Economies

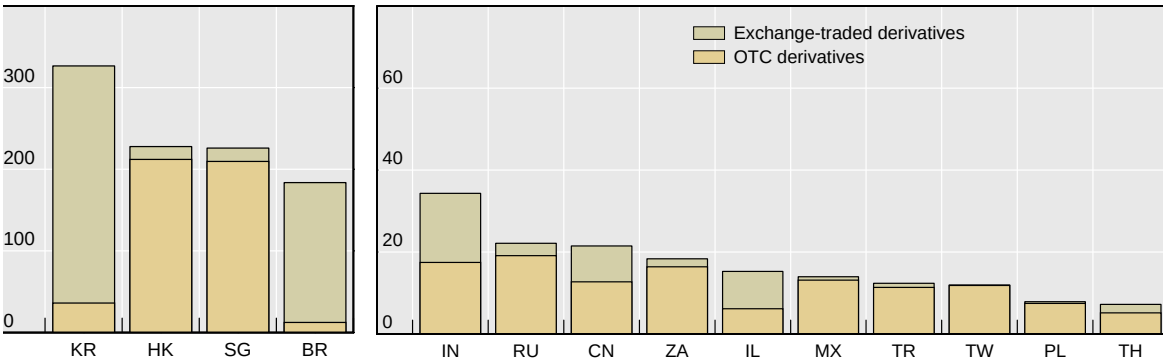
How does derivatives activity in emerging markets differ from that in the advanced economies? A 2010 study by the Bank for International Settlements[6] provides an answer. The study compares

[5]The notional outstanding figures across OTC and exchange-traded markets are not comparable. In OTC markets, the risk in a contract is often laid off by opening another offsetting contract with a different counterparty, which inflates the notional outstanding amount. In the exchange traded market, the original contract is closed out by taking the opposite position in the same contract, which leaves the notional outstanding the same or smaller.

[6]Mihaljek, D. and F. Packer, "Derivatives in Emerging Markets," *BIS Quarterly Review*, Dec 2010, pp. 43-58.

Figure 1: Emerging Markets Derivatives Turnover

The figure shows emerging market daily derivatives turnover in 2010. The figures are in USD billions. Source: Mihaljek and Packer (2010), *BIS Quarterly Review*, December 2010.



BR = Brazil; CN = China; HK = Hong Kong SAR; IL = Israel; IN = India; KR = Korea; MX = Mexico; PL = Poland; RU = Russia; SG = Singapore; TH = Thailand; TR = Turkey; TW = Chinese Taipei; ZA = South Africa.

derivatives turnover[7] in emerging markets (EMs) and advanced economies (AEs) along several dimensions, including market size and market composition.[8] This section summarizes the findings.

Size and Growth At $1.2 trillion a day, derivatives turnover in EMs is an order of magnitude smaller than in AEs ($13.8 trillion). More pertinently, it is also substantially smaller as a fraction of GDP (6.2% for EMs versus 36% for AEs). The EM market, however, grew a bit faster over the period 2001-10, registering a growth of 300%, compared to 250% for the AEs.

Where does trading occur? 62% of the total derivatives turnover in AEs occurred on exchanges and 38% occurred in the OTC market. In EMs taken as a whole, the split was close to 50-50 meaning that OTC markets are, relatively speaking, more important in EMs. But the OTC-exchange split varies considerably across EMs. Of the four largest centers for EM derivatives (Hong Kong, Singapore, Brazil, and Korea), OTC derivatives had an overwhelming market share in Hong Kong and Singapore, while exchanges dominate in Brazil and Korea. As Figure 1 indicates, it is only in a few countries (India, Israel, and to an extent China), that OTC and exchange markets are of roughly equal size. In every other case, one or the other dominates.

[7] "Turnover" refers to the aggregate gross notional amount of all transactions struck during the period of the survey. Daily turnover figures are obtained by averaging the turnover figures for the entire period.

[8] The study looks at interest-rate, currency, and equity, but not commodity or credit, derivatives.

What risks are traded? The risks traded via derivative contracts are sharply different in AEs and EMs. In AEs, 77% of the total derivatives turnover is accounted for by interest-rate derivatives. In EMs, around 50% of the total derivatives turnover is in currency derivatives, and another 30% in equity derivatives; interest rate derivatives are relatively unimportant. These numbers likely reflect the reality that exchange-rate risk is a major concern in emerging markets,[9] while EM bond markets are not nearly as well-developed as in AEs.

What trades in EM OTC markets? OTC derivatives market turnover in EMs is almost completely dominated by currency derivatives (around 90%) with the remaining mostly taken up by interest-rate derivatives. (In contrast, OTC currency and interest-rate derivatives turnover in AEs are of roughly the same size.) Singapore and Hong Kong are the main OTC derivatives trading centers in EMs, accounting for over 60% of all OTC derivatives trading trading activity.

What trades on EM exchanges? Equity derivatives account for well over 50% of all exchange-traded derivatives turnover in EMs, but this average number obscures vast differences across markets. Brazil and South Korea have the most well-developed derivatives exchanges (accounting, indeed, for almost 90% of the total EM exchange turnover). In Brazil, the turnover predominantly consists of interest-rate derivatives, with currency derivatives a distant second, and equity derivatives trailing even further behind. In South Korea, equity derivatives are a huge component of the exchange-traded market, with a turnover exceeding $270 billion a day (nearly a fifth of *all* emerging market derivatives activity, and globally second only to the CME in equity-derivatives turnover). Other countries with active equity-derivatives markets and exchange turnovers exceeding $10 billion a day include Brazil, Hong Kong, India, and Singapore.

3 Uses of Derivatives

This section touches upon the broad uses of derivatives in managing risk, discussing the uses by instrument. Section 4 complements the material presented here by discussing the risks in these instruments. Further details on the uses of derivatives may be found in, e.g., Rangarajan K. Sundaram and Sanjiv R. Das, *Derivatives: Principles & Practice*, McGraw-Hill, 2010. Readers familiar with the common uses of derivatives—hedging, insurance, speculation, etc.—can skip ahead to the next section.

[9] Econometric analysis indeed shows that currency derivatives activity in EMs increases almost one-for-one with trade flows and more than one-for-one with economic growth.

Futures & Forwards A common motivation for entering into a forward or futures contract is to *hedge* an existing market exposure, that is, to reduce cash flow uncertainty from the exposure. Consider, for example, a soybean farmer anticipating a crop of 10 tons in three months' time. The farmer is exposed to fluctuations in the price of soybean, in particular to the risk of falling soybean prices in three months. By entering into a three-month soybean forward contract as the seller, the farmer can lock-in a price for the anticipated crop, and so insulate revenues received in three months from price fluctuations.

The buyer in the forward contract in this example may be a hedger with the opposite exposure, for example, an agribusiness using soybean as an input in its production that wishes to lock-in a price at which it purchases the soybean. Alternatively, the buyer may have no prior exposure to soybean prices and may be using the forward contract to *speculate*, i.e., to look to profit from an increase in soybean prices relative to the price paid under the contract. Speculation is the other common motivation for entering into forwards or futures, and indeed speculators are an important component of the market, significantly enhancing its liquidity and making it possible for hedgers to find counterparties for their trades. Since forwards and futures involve a relatively small cash flow up-front—collateral in the case of forwards, margin in the case of futures—they provide investors with substantial leverage, a feature of particular interest for speculators (but one that, as we discuss in Section 4 also increases the riskiness of these instruments).

The futures/forward market is a large and diverse one. Interest-rate forwards (or "forward-rate agreements"), which may be used by investors to lock-in an interest rate for borrowing or lending over a specified period in the future, had a total notional outstanding in December 2011 exceeded $50 trillion (with another $20+ trillion in notional outstanding in interest-rate futures). Currency forwards, which may be used to lock-in an exchange rate for future purchase or sale of a foreign currency, had a notional outstanding of over $30 trillion in December 2011. Commodity forwards, instruments for locking-in prices for future sale or purchase of a commodity, had a notional outstanding in December 2011 of almost $2 trillion.

Options While a forward contract is an instrument for *hedging*, an option provides a form of financial *insurance*. Consider, for example, an investor who is looking to buy gold in three months' time. Suppose the investor buys holds a call option with a strike of $1,800/oz and an expiry date in three months. If the price of gold in three months is greater than $1,800/oz (for example, it is $1,840/oz), then the investor will exercise the right in the contract and buy the gold for the contract price of $1,800. However, if the price in 3 months is less than $1,800/oz (e.g., is $1,780/oz), the investor can choose to opt out of the contract and, if necessary, buy the gold

directly in the market at the cheaper price of \$1,780/oz. Thus, holding the call option provides the investor with protection ("insurance") against an *increase* in the price above the contract's strike, even while allowing her to take full advantage of price decreases. The writer of the call option who takes the opposite side of the contract is the provider of this insurance.

Analogously, a *put* option on gold provides a potential *seller* of gold with insurance against a *decrease* in the price. For instance, consider an investor who is planning to sell gold in three months, and who buys a put option on gold with a strike of \$1,800/oz expiring in three months. If the price of gold in three months is below \$1,800/oz, the investor can exercise the right in the put and sell the gold for \$1,800/oz, but if the price of gold rises to more than \$1,800/oz, then the investor can elect to let the put lapse and sell the gold at the higher market price. Holding the put insures the investor against a fall in the price below \$1,800/oz.

Options offer an alternative to forwards for investors concerned about future price fluctuations. Unlike forwards, there is an up-front cost of buying an option (viz., the option premium) but, compensating for this, there is no compulsion to exercise if doing so would result in a loss. That is, there is never exercise-time regret in an option.

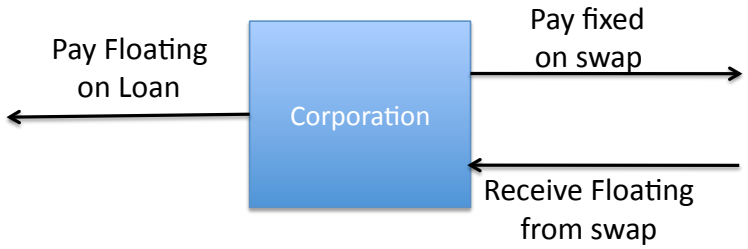
Options may be combined into portfolios to create richer desired payoff patterns. For example, suppose an investor has a position in a stock and desires protection against a fall in the price of the stock even while profiting from price increases. This may be achieved by adding a put option with strike K to the portfolio. The combined portfolio, called a *protective put*, has the property that its value can never drop below K—the investor can always exercise the put and sell the stock for K—but it benefits fully from stock price increases.

As a second example, consider an investor who is uncertain regarding the direction of the market but who expects considerable volatility (i.e., large price moves) in either case. By combining a call with strike K and maturity T with an otherwise identical put, the investor obtains a portfolio (called a *straddle*) that is neutral on direction—the call makes money if prices increase, the put if prices decrease—but that profits from volatility—the larger the price move in either direction, the higher the payoff to the investor.

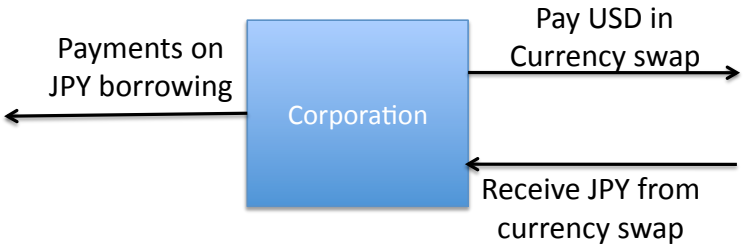
An option typically costs a fraction of the value of the underlying and provides the holder with one-for-one exposure to price moves beyond the strike (calls to price increases above the strike, puts to price decreases below the strike). As a consequence, options are also highly levered instruments. Calls are analogous to levered long positions in the underlying, puts to levered short positions. (Options are, however, more complex than just a simple levered long or short, since the nature and size of the implied leverage varies with the "moneyness" of the option, i.e., how far from the strike is the current underlying price.)

Swaps Swaps enable transforming exposures to one stream of cash flows into exposure to a different stream. Interest-rate swaps can, for example, be used to transform fixed-rate cash flows into floating-rate cash flows. Currency swaps can be used to transform cash flows in one currency into cash flows in another currency. Equity swaps may be used to transform fixed-income cash flows into equity-lined cash flows (or vice versa). And so on.

As an example, consider a corporation that has a floating-rate loan indexed to (say) LIBOR, and wishes to convert this to a fixed-rate exposure. A simple way to do this is to enter into a fixed-for-floating interest rate swap where the corporation pays a fixed rate to the swap counterparty and receives a floating-rate payment indexed to LIBOR in exchange. The corporation's net cash flow payment, as shown in the figure below, is now a fixed-rate payment: it pays floating on the borrowing, receives floating from the swap, and pays fixed in the swap.



As a second example, consider a corporation that has raised money in (say) Japanese yen but wishes to convert its exposure into US dollars. The company can enter into a USD-JPY currency swap in which it makes USD payments to the swap counterparty and receives JPY payments in return. Combined with the JPY borrowing, this results in a net cash outflow in USD.



A fundamental use of swaps is in financing. Swaps enable companies to raise money in the markets where it is cheapest and then to swap it into the kind of exposure they desire. For example, a large global company may find that there is greater demand for its debt in Japan than in the US, but it may desire funding in dollars. In this case, the company can raise money in yen, and then use a currency swap to swap the loan into dollars as illustrated above.

An example of such a transaction is the $10 billion 1996 swap between the European Investment Bank (EIB) and the Tennessee Valley Authority (TVA). While both were AAA-rated entities, the EIB was viewed by the markets as a very slightly better credit risk than the TVA. The EIB wanted funding in Deutsche Marks (DEM) and the TVA in US dollars, but the total borrowing costs were 3 basis points (bps) cheaper if each borrowed in the other's currency—the EIB was able to borrow 7 basis points (bps) cheaper than the TVA in USD, but only 4 bps cheaper in DEM. So each entity borrowed in the other's currency, and then a currency swap was used to convert the borrowings into the desired currencies.

Swaps are versatile instruments with many other uses as well. For example, they provide companies with financial flexibility. A company that anticipates lower interest rates in the future can borrow floating now and swap this into fixed if and when interest rates do decrease. And, of course, swaps can be used for speculation. An investor who anticipates higher interest rates in the future can enter into a pay-fixed/receive-floating interest rate swap; if interest rates go up as anticipated, the floating cash receipts increase even as the fixed cash payments stay the same, leading to a positive value for the swap.

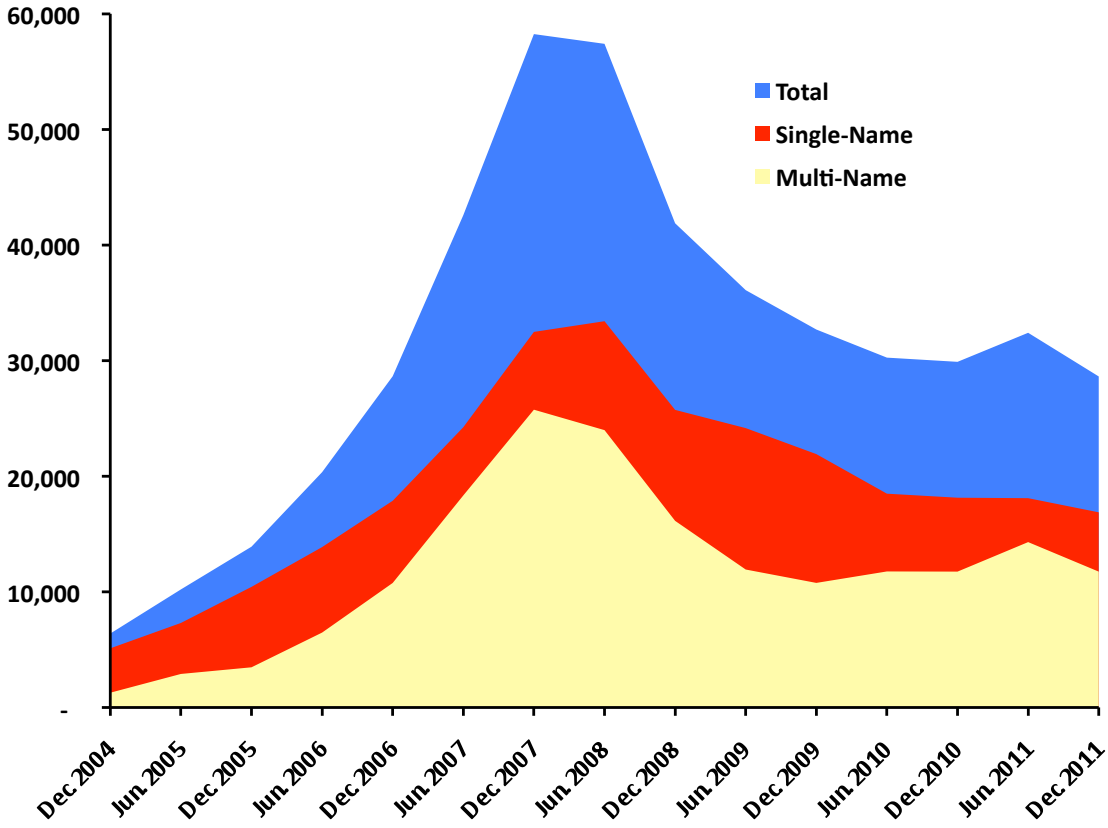
Credit Derivatives Credit default swaps (CDSs) enable investors to trade in the credit risk of an instrument separate from its other risks. Thus, for example, a bank can enter into a CDS with an investor in which the bank transfers the credit risk in a loan (or portfolio of loans) to the investor in exchange for making the investor a steady stream of "premium" payments.

From the bank's standpoint, the CDS provides a means for trading in risks that are otherwise highly illiquid. Effectively, the CDS provides the bank with a means of taking a short position in the credit but without moving the credit from the bank's books, therefore without losing any voting or servicing rights that may come with it. This frees up bank capital for making further loans. In principle, it also enables better portfolio management, as well as management of internal and regulatory constraints.

From the investor's standpoint, the CDS provides a means of taking exposure to an entire asset class (e.g., syndicated loans) to which no access would be available otherwise. Since the investor is typically required to post a collateral that is only a fraction of the face value of the loan/bond, the CDS also provides the investor with substantial leverage in taking this exposure.

Few instruments have enjoyed greater success upon their introduction than did credit derivatives in the first half of the 2000s. The market for these products grew from almost nothing in 2000 to a nearly $60-trillion market by 2007 (Figure 2). The financial crisis has subsequently caused a halving of the market, but it remains a huge and very active one.

Figure 2: The Credit Derivative Market: Growth



Source: Bank for International Settlements

4 The Potential Risks in Derivatives Usage

The danger in derivatives usage comes from the interaction of three factors that form a potentially lethal cocktail if the risks are not properly understood and managed.

The first is leverage. Derivatives are highly levered instruments. For example, futures contracts in practice often have margin requirements of around 10% (or less) of the value of the contract, yet give one-for-one exposure to changes in the futures price, so provide 10$\times$ or more of leverage. Leverage creates the potential for large gains but also large losses if the market moves in the wrong direction.

The second is volatility, Market volatility compounds the effect of leverage. As volatility in the price of the underlying increases and unexpectedly large price movements occur, the impact of leverage gets exacerbated leading to potentially larger losses on the downside.

The third is (il)liquidity. Periods of market turmoil are often accompanied by not only higher volatility but also liquidity drying up selectively. This makes it harder to exit unprofitable strategies (or even to hedge the derivative with the underlying), increasing the risk of the derivatives position.

Almost every major derivatives-related corporate debacle can be traced back to a combination of these factors. Here is a small sampling of some famous cases. All but one—the exception is Metallgesellschaft—involved speculative trading, and in all cases, a sharp unexpected market move led to losses that bankrupted the concerned entity. Further detail on the cases may be found in Sundaram and Das (2010, *op. cit.*).

4.1 Barings Bank

Barings, founded in 1762, was, in 1995, London's oldest merchant bank when a single individual, Nick Leeson, the sole trader in Baring's Singapore office, ran up huge losses that brought down the bank. The details are uncomplicated. Leeson built up massive positions in long futures and short straddles (i.e., short calls and short puts) on the Nikkei 225. The total notional value of his derivatives positions exceeded $33 billion, *more than 50 times Barings' entire capital of around $600 million*. When the Nikkei fell sharply following the Kobe earthquake in January 1995, Leeson's long futures and short put positions ran up losses exceeding $1 billion, shuttering the bank.

There are two important lessons from the Barings debacle. The first concerns operational risk. Barings had remarkably poor operational controls for a bank. Leeson was not only the trader in Singapore, he was also his own back office responsible for settling his trades; this was analogous to putting the cashier in charge of reporting daily cash inflows. This arrangement enabled Leeson to hide the true nature of his exposures from his head office in London.(Indeed, Leeson's job responsibilities explicitly forbade him from taking on propreitary positions that exposed Barings to market risk, but he did so anyway). The second is the lethal leverage-volatility exposure Leeson created. The in-built leverage in derivatives contracts enabled Leeson to build up his massive exposures while committing relatively little capital. The effects of this leverage brought down the bank when volatility spiked and the Nikkei moved sharply down in January 1995. Absent access to derivatives it is doubtful if Leeson could have done this much harm.

4.2 Metallgesellschaft

The Metallgesellschaft case is unique in the annals of derivatives disasters in that it involves not fraud or speculation, but a commonly-used hedging strategy. In the early 1990s, Metallgesellschaft AG was one of Germany's largest industrial conglomerates and had over 20,000 employees. Its American subsidiary Metallgesellschaft Refining and Marketing (MGRM) was set up in the early 1990s with the goal of capturing a share of the refined oil market in the US. MGRM used an aggressive marketing strategy that called for periodic (often monthly) supply of refined oil *at fixed prices* out out several years in the future. The company quickly built up huge supply commitments amounting to more than 150 million barrels.

The huge commitments left MGRM exposed to increases in the price of crude oil. To hedge this risk and lock-in a margin, the company took up massive long futures positions in crude oil on the New York Mercantile Exchange (NYMEX), and supplemented this with similar OTC arrangements. But futures contracts are marked-to-market every day, while on the forward commitments Metallgesellschaft would receive money only when it actually delivered the oil. Unfortunately for MGRM, oil prices fell by over 25% in late 1993. The company faced a huge cash requirement to meet its futures losses and keep its hedge afloat. (To be sure, the forward positions were now worth more, but there was no cash coming in from these.) OTC counterparties, sensing trouble, too demanded increased collateral.

Unable to meet the subsidiary's cash requirements, the parent company Metallgesellschaft AG closed down the hedge. The resulting massive losses exceeding $1 billion put its parent company into bankruptcy, from which it eventually reemerged only in 2000. The much-shrunken company is today part of the GEA Group.

The details of Metallgesellschaft's hedging strategy have attracted much attention, with some commentators suggesting the company may have over-hedged its position. But the general strategy of hedging forward commitments with futures contracts is a commonplace one, and it is not hard to see that a cash crunch stemming from a sharp fall in oil prices was the most obvious and proximate risk that MGRM faced. Yet, when oil market volatility hit, the company was caught unprepared.

4.3 Amaranth

A hedge fund initially trading mainly in convertibles, Amaranth had offices in Greenwich, Connecticut, as well as in Toronto, Singapore, and London, with an employee head-count in the hundreds. Amaranth got into energy (particularly natural gas) trading in 2002. The energy

group was spectacularly successful in 2005, with its directional bets using options paying off handsomely when Hurricane Katrina sent natural gas prices soaring that year. In early 2006, the fund again took a series of bets on the behavior of natural gas prices in 2006-07. A simplified description of the bets was that that summer 2006 prices would fall relative to winter 2007 ("short summer, long winter"). The bets were implemented using futures contracts.

Substantial leverage was involved. At its peak in 2006, Amaranth had $50 billion in natural gas futures positions against the entire fund's capital of under $10 billion. And this in a market (natural gas) that was known to be a highly volatile one.

Liquidity was—or should have been—another key consideration. Its massive futures positions had made Amaranth a significant fraction of the entire market. In mid-2006, e.g., Amaranth held 52% of the open interest in Jan-07 futures, and 57% of the open interest in Nov-06 futures. By end-July, Amaranth held 40% of the total open interest in the winter months contracts.

Amaranth's strategy seemed profitable on a marked-to-market basis during the build-up and well into 2006, but this may have been illusory and just a consequence of Amaranth's own trading. The fund's huge futures transactions moved prices making its earlier trades in the same contract appear profitable. (For example, its purchases of Jan-07 futures pushed that contract's price higher making earlier purchases of that contract seem profitable.) Indeed, when Amaranth tried to lock-in profits and exit some trades, it found it could not do so without moving prices significantly against it.

In early fall 2006, prices started moving sharply against Amaranth, but the firm found it could not exit its huge positions without further moving prices unfavorably. In three weeks in September, Amaranth lost over 45% of its $9.7 billion of capital. By the time the fund closed down a short time later, total losses had exceeded $6 billion.

4.4 Aracruz Cellulose

The first Brazillan company to be listed on the New York Stock Exchange, Aracruz Cellulose was the world's largest manufacturer of bleached eucalyptus pulp. It had 2007 earnings exceeding $1.4 billion, and a mid-2008 market cap of around $7 billion.

The company derived more than 90% of its revenue in USD from exports, while its costs were entirely in the Brazilian real (BRL), so the company was exposed to changes in the BRL/USD exchange rate. As a routine matter, the company used currency derivatives (mainly forwards and futures) to offset this risk. Effectively, the company locked-in a rate at which it could sell USD in the future for BRL, thus protecting its revenues in BRL.

Until 2008, the size of the company's derivatives positions was roughly equal to its anticipated revenues, so the derivatives were hedging the existing foreign-exchange risk. But in 2008, the company increased massively the size of its derivatives positions—one study[10] estimated the derivatives positions were nearly 6 times the company's exposure—so the company was essentially speculating hugely on the USD falling against the BRL. The instruments it used were correspondingly aggressive, for example, *target forwards* in which the loss the company would face if the dollar appreciated were twice the benefit it would reap if the dollar depreciated by a like amount.

From 2003 until mid-2008, the USD had indeed fallen steadily against the BRL, with the exchange rate going from around BRL 3.50/USD in 2003 to BRL 1.60/USD by mid-2008. But in September and October of 2008, this trend sharply reversed course, and the USD gained 25% against the BRL in a little over a month. In October 2008, Aracruz disclosed losses of over $2 billion on its derivatives position. Its stock price plunged as a result, eventually falling over 80%. The company was eventually acquired by its smaller competitor Votorantim, and the new merged company was renamed Fibria.

4.5 AIG

Operating through its financial subsidiary, AIG Financial Products, the US giant American Insurance Group (AIG) sold around $450 billion of credit default swap (CDS) protection on a variety of reference obligations including super-senior tranches of Collateralized Debt Obligations or CDOs. The positions were left unhedged. Presumably the idea was that with low individual default probabilities and a well-diversified portfolio, defaults should not bunch together in such quantities as to cause catastrophic losses in the portfolio. In effect, AIG was short a put option on the US macroeconomy, that is, it was taking a bet that there would be no *systemic* crisis in the US economy causing all markets to fall at the same time. Unfortunately, such a crisis did hit, and in times of economic crisis, defaults do tend to bunch and default correlations to increase generally, though it was not increased numbers of defaults that caused AIG's collapse.

Rather, as the seller of CDS protection, AIG had been required to post collateral to protection buyers. When US real estate prices declined steeply in 2008, AIG was required under accounting rules to mark down the value of its mortgage-backed securities portfolio. This reduced its capital reserves, in turn leading to a sharp downgrading of AIG by the major ratings agencies. The down-

[10] Rodrigo Zeidan and Bruno Rodrigues (2010) "The Failure of Risk Management for Non-Financial Companies in the Context of the Financial Crisis: Lessons from Aracruz Celulose and Hedging with Derivatives," Nottingham University Business School. The paper contains a detailed description and analysis of Aracruz's hedging/speculation strategy.

grading resulted in counterparties to the CDS contracts demanding substantial extra collateral, over $100 billion in all. This was money AIG simply did not have, and resulted in the huge—and contentious—US government bailout of AIG which by early-2009 had consumed more than $180 billion.

While it was the steep decline in the US real estate market and the consequent losses on mortgage-backed securities that provided the proximate cause of AIG's collapse, the reason these factors constituted more than just a manageable financial setback for the insurance giant was, once again, the leverage-volatility combination, in this case, the hundreds of billions of dollars of protection AIG had sold and left unhedged.

4.6 Heeding the Lessons?

With changes in the date and the names of the actors, the stories described above have been repeated several times in the last two decades.

Like Barings, poor operational controls have proved costly for several others. The Japanese trading powerhouse Sumitomo lost $2 billion in 1995 due to what the company described as unauthorized copper trading over a *10-year* period by a single trader, Yasuo Hamanaka. Recent front-page stories, also centering on unauthorized trading that went undetected for a long time, include the cases of Jérôme Kerviel in 2009 (who lost the French banking giant Société Générale €5 billion) and Kweku Adoboli in 2011 (who cost Swiss banking major UBS $2.3 billion).

Nor was Aracruz's move from using derivatives to hedge to using them to speculate an isolated one. Watching the USD steadily weaken against their domestic currencies through much of the early- and mid-2000s, several emerging market companies went the same way—and paid a severe price when the trend abruptly reversed in in late-2008. The list includes many Indian companies (e.g., Sundaram MultiPap, Rajshree Sugars, Nitin Spinners, Nahar Industrial Enterprises, and Sundaram Brake Linings). In part due to court intervention, not all Indian companies paid the full price. Sundaram Brake Linings, for instance, is estimated to have lost over INR 1,090 million on currency derivatives speculation, but paid out under INR 100 million in all over two years, with the banks on the other side of the transactions presumably absorbing much of the losses.[11]

Amaranth, Metallgesellschaft, and AIG all exhibited poor management of tail risk—in particular, in underestimating the likelihood of extreme price moves, and so being caught unprepared when such moves transpired. This is perhaps the most common story of all. Many financial

[11] See, for example, http://www.rediff.com/money/report/its-advantage-clients-in-fight-over-derivatives-losses/20100520.htm.

institutions that failed—or survived only by being bailed out—during the recent financial crisis were guilty of the same shortcoming. Going a bit further back in time, the spectacular failure of the hedge fund LTCM in 1998 (which led to a multi-bank rescue coordinated by the Federal Reserve Bank of New York) falls into this category.

By being a huge part of the market in which it was trading, Amaranth also created liquidity problems for itself, increasing the complexity of managing a bad trade. J.P. Morgan Chase found itself in the same boat in 2012, when the CDS index trades put on by Bruno Iksil, a trader in its CIO's office, resulted in enormous losses for the bank (at last count $5.80 billion). As with Metallgesellschaft, Iksil's trades were supposed to be hedges, offsetting exposures elsewhere in the bank, but as with Metallgesellschaft (albeit for different reasons), the hedge does not appear to have created the desired end result.

In the final analysis, derivatives, like dynamite, constitute an invaluable tool when utilized with understanding and care, but indiscriminate usage can spell disaster for he user. The presence of proper operational controls—especially the identification and prevention of unauthorized trading—is the most obvious initial requirement, but also needs to be supplemented with an understanding of the risks involved, and an ability to quantify the impact of, and provide capital against, extreme price movements and "worst-case scenario" outcomes.

From a regulatory standpoint, derivatives failures are a concern particularly when they have systemic implications, as in AIGs case. This and related issues are discussed in Section 6.

5 Derivatives in the Indian Context: Some Comments

Derivatives trading in India is several decades old, but it is only over the last two decades that derivatives markets have been liberalized and derivatives trading have been allowed to grow. The principal regulatory authority for OTC derivatives markets in India is the Reserve Bank of India (RBI), while exchange-traded derivatives come mainly under the purview of the Forwards Market Commission (FMC) and the Securities Exchange Board of India (SEBI),

As part of financial market reforms, the RBI first permitted OTC trading in currency options and FX swaps in the mid 1990s (currency forwards were already bring traded), and in interest-rate derivatives (mainly forward-rate agreements and interest-rate swaps) from 1999. Restrictions were placed on participation to discourage speculation; for example, users were required to have an existing exposure that was being hedged via the derivative. Trading in credit default swaps began very recently in December 2011.

Volume growth has been robust. The RBI estimates[12] that by December 2009, the notional outstanding in OTC currency derivatives contracts with banks was around $775 billion, over 85% of which were in forward contracts. OTC interest rate contracts had a notional outstanding of just under $1 trillion, with interest rate swaps accounting for almost the entire amount. Almost 85% of the swaps were based on the Mumbai Interbank Offered Rate (MIBOR), with overnight-indexed swaps (OIS) based on overnight MIBOR the most popular.

Exchange-traded derivatives are offered by several entities including the Bombay Stock Exchange (BSE), the Multi-Commodity Exchange (MCX), the MCX Stock Exchange (MCX-SX), the National Commodity and Derivatives Exchange (NCDEX), the National Stock Exchange (NSE), and the United Stock Exchange (USE). Derivatives on equities and equity indices trade at the BSE and the NSE; on currencies at the MCX-SX, the NSE, and the USE; on Treasurys (i.e., Government of India securities) at the NSE; and on a range of agricultural commodities, metals and energy on the MCX and NCDEX.

Growth of exchange-traded derivatives has also been rapid. The Futures Industry Association estimated that by December 2011, measured in terms of number of contracts traded or cleared, three Indian exchanges ranked in the top 30 worldwide, headed by the NSE at No. 5 (just behind NYSE Euronext), MCX at No. 9, and the USE (which almost tripled in size in 2011) at No. 13. And by the same measure, several individual derivatives contracts (USD-INR futures, USD-INR options, Nifty index futures, natural gas futures, and others) ranked in the top 20 worldwide in their categories.

Overall, the picture is of a derivatives market that has enjoyed steady growth without engendering major market disruptions. Yet, this picture is not the whole truth. Opportunities have not been fully exploited, and there are substantial problems inhibiting growth. The material below elaborates.

Currency Derivatives The demand for risk protection is primarily a function of the extent of risk one faces, i.e., of market *volatility*. Figure 3 describes the evolution of the INR-USD exchange rate (INR per USD) over the period January 2004 to July 2012. This is a volatile market characterized by large moves over relatively short periods of time. For example, the rupee appreciated by around 15% from late 2006 to late 2007; it has experienced a depreciation of a similar magnitude in 2011-12. Exchange-rate volatility has also gone up in recent years, with many more weekly changes exceeding $\pm 2\%$.

[12] See Shyamala Gopinath (2010) "Over-the-Counter Derivatives Markets in India: Issues and Perspectives," Banque de France Financial Stability Review 14, July 2010.

Figure 3: The INR-USD Exchange Rate

For businesses active in foreign trade, this volatility poses an obvious and major risk, which currency derivatives offer important ways of mitigating. It is of no surprise, then, that given the almost 10-fold growth in Indian merchandise and services trade since 2000, the Indian currency derivatives market has also grown sharply, both OTC market and on exchanges. Concerning the OTC market, the BIS (see Mihaljek and Packer, 2010, *op. cit.*) estimates that around 4.5% of all OTC foreign exchange derivatives contracts traded worldwide in 2010 involved the rupee as one of the currencies in the transaction. Regarding the exchanges, according to the Futures Industry Association, when measured by the total number of contracts traded or cleared, the top three currency contracts worldwide were the USD-INR futures contracts on the MCX-SX, NSE, and USE, respectively, while fourth place went to the USD-INR options contract on the NSE.[13] Overall, currency derivatives trading is at about twice the volume of spot trading, roughly on par with the rest of the world.

All this is to the good. On the other hand, there is indirect evidence that regulatory costs, tax policy uncertainty, and restrictions barring foreigners from trading currency futures on the exchanges are pushing business overseas. The BIS study cited above finds that almost 60% of currency derivatives turnover involving the Indian rupee took place outside India,[14] and the

[13]To be sure, the small contract sizes make these numbers appear more impressive than they really are. One contract on the NSE, USE, or MCX-SX is for USD 1,000, compared to, for example, a size of EUR 125,000 (approximately USD 160,000) for the euro futures contract on the Chicago Mercantile Exchange.

[14]This is not unusual for an emerging market—the overall figure for all emerging markets combined was 77%,

figure appears to be growing. USD-INR volumes have surged on the Dubai Gold & Commodity Exchange and the Bahrain Financial Exchange, in addition to traditional OTC centers like Hong Kong and Singapore. Anecdotal evidence even suggests that offshore centers such as Singapore are becoming the primary centers of price discovery in INR currency derivatives.

Equity Derivatives Figure 4 describes the behavior of the Nifty index over the period January 2004 to July 2012. Again, this is a very volatile market with sharp spikes. Weekly returns of 5% or more are not uncommon, and on occasion, returns have exceeded $+12\%$ or been worse than -15%. For individual investors, especially, this volatility acts as a powerful inhibitor from participating in equity markets, and this, in turn, limits the liquidity and depth of the overall depth and liquidity of the market.

Equity derivatives address some of these concerns, and unsurprisingly such derivatives (single-stock futures, index futures, options on individual equities, and options on the indices) have enjoyed huge success in the Indian market, with daily turnover of over $20 billion. Derivatives trading is now several times larger than cash trading in equity markets measured by daily notional turnover. Measured by the number of contracts traded or cleared, the Nifty futures contract was, in 2011, the second largest exchange-traded equity-derivatives contract in the world according to the Futures Industry Association.

Impressive as these numbers are, they hide significant weaknesses. Nifty futures are also traded in Singapore on the SGX and have seen strong growth there. Indeed, recent reports on trading volumes[15] indicates that open-interest volumes on the SGX have overtaken those on the NSE; much of the Singapore growth appears to be caused by regulatory and tax uncertainty in India, an area of ongoing concern for investors.

A second problem, partly structural, partly policy-induced, is liquidity in the market for the underlying, a key requirement for a successful derivatives market. Although India's equity-market-capitalization-to-GDP ratio is on par with more advanced economies, Indian equity markets currently lack depth. It has been estimated, for example, that the American Depository Receipts (ADRs) of Infosys, one of India's largest and most-traded stocks, has a greater turnover on Nasdaq than the company's Indian shares do on Indian equity exchanges, even though the ADRs account for less than 15% of Infosys' outstanding shares. The situation was similar for several

and for certain currencies like the Brazilian real or the Mexican peso, the figure exceeds 90%—but it does indicate a situation where local regulators and monetary authorities have little control, and is not a stable situation in the long-term in a world of global capital and competition.

[15] See "FIIs Bet Heavily in Indian Market, But in Singapore," (*Business Standard*, 26 May, 2012) or "GAAR, Policy Paralysis Hit Local Trading" (*Economic Times*, 6 June, 2012).

Figure 4: The NSE Nifty Index: 1/2004 - 7/2012

other large Indian companies such as ICICI Bank and HDFC Bank.

Tax policy is a substantial contributor to the handicapping of Indian markets. The securities transaction tax (STT) single-handedly lifts trading costs on Indian exchanges to uncompetitive levels, negating the greater liquidity they can, in principle, provide.[16] With the 2012 Union Budget adding further uncertainty in the form of the General Anti-Avoidance Rules (GAAR), leading to further capital flight, it is fair to say that far from enhancing liquidity, policy in parts has almost been geared towards derailing it.

Commodity Derivatives Commodity prices are notoriously volatile. In principle, derivatives based on agricultural products could help considerably at managing the risk in agricultural activity and perhaps stabilizing farm incomes. Derivatives markets too provide signals about future prices of various crops that help considerably in planning production. Again, the raw numbers are impressive. Measured in terms of number of contracts traded or cleared, the NCDEX's Guar

[16] One recent study (see "Nifty futures volumes in Singapore exchange soar 30% in 2011," *Business Line* 15 January 2012) found that for a round-trip transaction in INR 100,000 of Nifty futures, the cost on the NSE at INR 29.06 was almost thrice the INR 11.22 cost on the SGX, despite the exchange fee of 1.75 on the NSE being only a third of the 5.12 exchange fee on the SGX. The STT at INR 17.00 accounted for almost the entire difference, with service tax and stamp duty adding an additional 3.59 of extra costs compared to their Singapore counterparts.

Seed Futures contract ranks among the Top 20 exchange-traded agricultural futures and options contracts worldwide. Using the same measure, three futures contracts make it to the Top 20 exchange-traded energy futures and options contract worldwide—the crude oil futures contracts on the MCX and NCDEX, and the natural gas futures contracts on the MCX. The MCX also has eight of the Top 20 metals futures and options contracts worldwide.[17]

Nonetheless, serious problems abound, particularly in the realm of agricultural commodities; the market is very far from realizing its potential. The principal challenge is ensuring a liquid market in the underlying commodity with specified quality standards. Futures contracts trade on acceptable deliverable grades, and the spot market in India is poorly developed in this context. What trades in the country's *mandis* does not always constitute a deliverable grade on the agricultural futures contracts traded on the commodity exchanges, the NCDEX or MCX. As a consequence, there is significant "basis risk" in using the futures contract to hedge spot price risk. The correlation—the critical measure of how good a hedge the futures contract provides—between spot price changes as measured on the *mandis*, and futures price changes can be very low. An unpublished study by the author in 2008 found, indeed, that this correlation approached zero for certain contracts, implying the futures contract provided no hedge at all against spot price risk.

At the same time, attempts to develop alternative ways to manage agricultural risk—for example, by introducing derivatives linked to publicly observable variables, such as weather- (e.g., local rainfall-) or temperature-based derivatives—have struggled to gain traction, in part because they come with significant basis risk, making their successful design a non-trivial problem. Addressing the notoriously-poor quality of agricultural infrastructure (including storage and transportation facilities) and facilitating the creation of liquid and transparent spot markets is an urgent requirement facing the country.

Interest Rate Derivatives World-wide, interest rate derivatives constitute the largest chunk of the derivatives market, but this is largely driven by activity in the advanced economies. With a few exceptions like Brazil, emerging market activity in interest-rate derivatives is low, and India is no exception to this rule. In large part, this stems from poorly-developed bond markets. While government yield curves in advanced economies offer a common basis for valuing fixed-income instruments and gauging their risk, the absence of a liquid government bond market in India

[17] Once again, one should not take these numbers too literally. The size of a crude oil futures contract on the MCX and NCDEX at 100 barrels is one-tenth the size of the corresponding contract on the New York Mercantile Exchange (NYMEX). Similarly, one gold futures contract on the MCX is for 100 grams or approximately 3.5 ounces, about one-thirtieth the 100 oz-contract size of the NYMEX gold futures contract.

makes it difficult to compute a meaningful yield curve. This makes even measuring interest rate risk, let alone pricing and hedging fixed income instruments and derivatives, challenging. The fact that despite these obstacles, the market has developed a fair degree of liquidity in OTC interest-rate swaps (particularly OIS swaps based on overnight MIBOR) suggests the nascent potential in this market, though the exchange-traded market is yet to see the kind of success with Treasury futures that it saw with the introduction of currency futures.

Credit-Default Swaps and Credit Derivatives Banks remain a key source of capital in India and bank capital is scarce. The credit derivatives market could help free up bank capital by drawing in new investors. This is an area in which India has seen activity only since December 2011, but while there is considerable promise, the development of this market also faces important obstacles. Credit markets are relatively opaque, defaults are rare events, and there are few default databases. Thus, while a natural demand for protection exists (from banks and other financial institutions that are long credits on which they wish to purchase protection), developing a deep base of sellers of protection may take time.

6 Regulation and its Challenges

Derivatives regulation has long been a contentious area and a challenging one. One the one hand, derivatives allow for risk-sharing, an activity recognized by economists as welfare-enhancing. Forwards and futures, swaps, and options allow for mitigation of risks routinely faced by investors, transferring the risks from those who do not wish to hold them to those who are willing to do so. On the other hand, derivatives trading (particularly OTC derivatives) created concentrated pools of risks in financial institutions, and, as the recent crisis showed, the combination of leverage and volatility can rapidly become toxic, threatening not only the individual institutions but the entire financial system. Among issues that make regulation a challenge are the opacity of the OTC derivatives market and the increasing sophistication of the derivatives products employed, many of which seek precisely to create an end-run around regulations as they are written.

As the derivatives market has evolved, regulatory approaches have had to change alongside. The US experience in this regard offers a useful illustration. Two sets of laws regulated derivatives trading through most of the 20th century. The Commodity Exchange Act (CEA) of 1936, established the Commodity Exchange Administration as the principal regulator of futures trading in the US. This lasted almost four decades, until the Commodity Futures Trading Act was enacted in 1974, giving birth to the Commodity Futures Trading Commission (CFTC) as the regulatory

agency in charge of futures markets.

As the names suggest, regulation was primarily concerned with *commodity* derivatives, in particular commodity *futures*, because that was then the main form of derivatives market. But in the early 1970s, *financial* derivatives had begin trading on exchanges, and the rapid growth of this market gave rise to jurisdictional issues on whether futures on securities should be regulated as futures contracts by the CFTC or as securities by the Securities and Exchange Commission (SEC). In 1982, responsibilities were delineated. The SEC was given jurisdiction over options on securities and options on indices of securities (e.g., stock indices). The CFTC was given jurisdiction over all futures contracts including futures on securities, futures on indices of securities, and options on futures on such indices.

In 2000, the enactment of the Commodity Futures Modernization Act (CFMA) placed significant curbs on the oversight powers of the CFTC and the SEC. The CFMA effectively deregulated significant portions of the OTC derivative market, explicitly exempting certain instruments (mainly swap agreements) from CFTC oversight as "futures." The Act also exempted most OTC energy trades and trading on electronic energy commodity markets from government regulation. Spurred partly by the deregulation, and partly as a consequence of increased globalization and economic growth, the OTC derivatives market grew explosively in the following decade (see Table 1), a growth that started leveling off only when the financial crisis hit.

The financial crisis towards the end of that decade prompted yet another sweeping change in regulatory regimes, this one in the form of the Dodd-Frank Act, signed into law in July 2012.[18] The Dodd-Frank Act sets out three goals: (a) to minimize the systemic risk impact of derivatives trading, (b) create transparency in derivatives markets, and (c) to provide credit protection for derivatives traders against counterparty defaults. Towards achieving these, the Act requires many traditionally-OTC derivatives (or "swaps," as the Act calls OTC derivatives) that are sufficiently standardized to be cleared through a clearinghouse and traded on an exchange. For non-standard derivatives that are difficult to move to an exchange, the Act requires higher margin and capital requirements. Certain derivatives (such as FX swaps) have been exempted from the regulations.

From an oversight standpoint, the Dodd-Frank Act specifies multiple regulatory authorities with partially overlapping jurisdictions. For derivatives that are designated as "non-security-based swaps" (a category that includes interest-rate swaps, interest-rate options, and credit-default swaps based on broad indices), regulatory responsibility largely vests with the Commodity Futures Trading Commission (CFTC) with inputs from the Securities and Exchange Commission

[18] An excellent reference on Dodd-Frank, and the source for much of the summary description in this section, is http://us.practicallaw.com/3-502-8950#a866753.

(SEC) and others. Derivatives designated as "securities-based swaps" (e.g., single-name CDSs) generally fall under the purview of the SEC, with input provided by the CFTC. In addition, bank regulators are also given oversight over certain aspects of derivatives activities of banks including capital reserve requirements and reporting and compliance requirements.

Other important aspects of the Act include the "Lincoln Rule" and the "Volcker Rule." Under the former, also called the Pushout Rule, banks and other entities with access to the Federal Reserve Board's discount window or to FDIC deposit insurance are prohibited from engaging in derivatives trading activities; the rule effectively aims to persuade depository institutions to spin off their derivatives trading operations into separately-capitalized subsidiaries. Under the Volcker Rule, banking entities are prohibited from proprietary trading, and restricted in the forms of investments they may make in hedge funds and other private investment vehicles. Market-making activities are exempted from the prohibition.

Several concerns remain. Some are implementational issues, for example, the question of whose rules will apply in a derivative agreement between parties from different nations, or (say) whether or what extent the rules will apply to derivative agreements entered into with non-US parties by non-US branches of US financial institutions. Others pertain to the impact of the Act. For instance, while the requirement that derivatives be cleared on clearinghouses is intended to reduce systemic risk, there is a fear that exactly the opposite may be achieved, namely, that by concentrating all systemic risk within a few clearinghouses, systemic risk may actually be increased. Second, costs for end-users of derivatives may be significantly increased because of the increased capital and margin requirements/collateral posting associated with both standardized and customized (non-standard) derivatives, regardless of creditworthiness. Third, there is the fear that the Act handicaps US institutions vis-a-vis non-US institutions, so that the derivatives business of US institutions will be adversely affected. Lastly, in many ways, the rules are seen as strengthening the hand of large banks compared to smaller banks and end-users.

What lessons can an emerging market such as India draw from the US and Western regulatory experience and the ongoing reforms? The question is too big to be answerable within this note, but there are some points of obvious importance that deserve special consideration.

The most important is the push to have more derivatives traded on exchange-like platforms. This has obvious advantages in that there is transparency in trading, exposures are readily netted out, the collection of margin mitigates default risk as in futures exchanges, and individual institutions' total exposures and exposures to each counterparty are easily accessible to the exchange and the regulators. Balancing all this is a single large risk: the exchanges in such a world would truly become too big to fail. Regulatory oversight would also have to be considerable considering

the exchange's capitalization and its risk-management and margining systems. To run well, then, the system would have to consume greater financial and regulatory capital.

To be sure, even with the added costs, this is no panacea. The move to exchanges will not be sufficient to prevent every possible disaster. Barings and Amaranth traded exclusively on exchanges, and Metallgesellscaft, Aracruz, and others did a significant volume of their overall trading on exchanges. But the exchanges arguably would have shown up problems faster and made them more containable in a variety of cases (many of the Indian corporates, for example). And it is doubtful too that in the presence of position limits such as many exchanges impose, an exposure the size of AIG's portfolio could have developed. On balance, the arguments in favor of moving to exchanges outweigh those against it.

A Derivatives Instruments

This appendix describes the three basic kinds of derivatives—forwards, futures, swaps, and options—in some detail, and rounds off the presentation with a description of credit derivatives, particularly credit default swaps.

A.1 Forwards

Forward contracts are historically the oldest form of derivatives, and are, in fact, among the oldest form of all financial contracts, dating back thousands of years. Hugely important in their own right (see Section 2 for statistics on market size), they are also the basic building block of the derivatives world. Futures contracts emerged as exchange-traded versions of forwards about 160 years ago; swaps, which are effectively portfolios of forwards, arrived about 30 years ago.

In a forward contract, two parties (referred to as the "counterparties" to the transaction) agree to a specified trade to be carried out on a specified date in the future. All the terms of the trade—the underlying asset, the quantity, the price to be paid by the buyer, and so on—are spelled out in the contract. Both buyer and seller *commit* to the specified trade. Forward contracts are written on a wide range of "underlyings" including commodities (wheat, gold, copper,oil, ...), financial variables (equity prices, exchange rates, interest rates, ...), and other instruments (including once-exotic underlyings like electricity and market volatility).

Forward contracts are "over the counter" instruments, i.e., they are bilateral contracts negotiated directly by seller and buyer. On the plus side, this means that forwards are customizable to the specific needs of the counterparties. On the downside, it means that, absent other arrangements, each party is assuming the credit risk of the other counterparty, i.e., that the other counterparty may fail to honor its commitment under the contract.

There are two forms of settlement in a forward contract. In a *physically-settled* forward contract, the seller must deliver the quantity specified in the contract, and the the buyer must pay the price specified in the contract. In a *cash-settled* contract, the spot market price of the asset at maturity of the contract S_T is compared to the agreed-upon price F in the contract, and the loser must compensate the gainer for this difference. That is, if $S_T > F$, then the locked-in price on the forward contract is "better" for the buyer by $S_T - F$ compared to the spot market price, so the seller compensates the buyer for this difference. If $S_T < F$, the buyer pays the seller $F - S_T$.[19]

[19]For example, suppose the forward contract calls for delivery of 10 tons of soy at $1,100 a ton. Suppose the

A.2 Futures

Futures contracts are, in effect, forward contracts that are traded on organized exchanges. The world's first futures exchange was likely the Dojima Rice Exchange set up in Osaka, Japan, in 1730, but the advent of modern futures trading is more closely associated with the grain markets of Chicago, an era that began with the establishment of the Chicago Board of Trade in 1848.

Where in a forward contract the terms of the contract are arrived at bilaterally by buyer and seller, in a futures contract, an exchange sets all contract terms except the price: The exchange specifies the commodity or financial instrument underlying the contract, how many units of the underlying go into one contract, the delivery date for the contract, the minimum acceptable grade or quality of the underlying, etc. Buyers and sellers submit orders to the exchange indicating the number of contracts they wish to buy/sell and the prices at which they are willing to do so, and prices are arrived at by matching the submitted buy and sell orders.

Futures exchanges offer contracts on a wide variety of underlyings including agricultural commodities, metals, oil, equities and equity indices, interest rates, bonds, and foreign currencies. Most futures contracts are physically-settled, but some, such as stock index futures and interest-rate futures are commonly cash-settled.

Forwards and futures serve the same economic function, but the involvement of the exchange results in some important differences in the contracts:

1. Forward contracts are customizable to the needs of the counterparties. Futures contracts are *standardized* in terms of the size of the contract, the possible delivery dates and delivery locations, and the grade of the commodity or asset that may be delivered. This means futures contracts will generally not provide as good a hedge as forward contracts, unless the investor's hedging needs happen to coincide with the terms of the standardized contract.

2. In a forward contract, each party assumes the other's credit risk. In a futures contract, the exchange guarantees performance on the contract, so effectively becomes the counterparty to all investors. Each party is only taking on exposure to the exchange's credit risk, which results generally in lower credit risk in a futures contract compared to a forward.

Investors in futures markets are required to post "margin," which is essentially collateral against default. The margin balances are *marked-to-market* every day, that is, they are adjusted

spot price of soy at maturity of the contract is, say, \$1,180 a ton. Then, the buyer in the forward contract has gained \$80/ton over the prevailing spot price, so the seller pays the buyer a total of $\$(80 \times 10) = \$800$. On the other hand, if the spot price at maturity is (say) \$1,040/ton, then the seller in the forward has gained \$60/ton on the forward contract, so the buyer pays the seller a total of \$600.

for gains and losses that occur from daily futures price movements. The operation of margin accounts is a key ingredient in maintaining the financial integrity of futures contracts.

A.3 Swaps

Swaps, like forwards, are over-the-counter contracts. In a forward, the two counterparties commit to a single trade or single exchange of cash flows. In a swap, the counterparties commit to multiple exchanges of cash flows over several dates in the future.

Swaps are relatively young as a product class, first making their appearance only in the late 1970s. Nonetheless, they are today by far the single largest component of the world derivatives market, accounting, in notional outstanding terms, for over 60% of the over-the-counter derivatives market (see Section 2)

Swaps are most commonly used in the interest rate market ("interest-rate swaps"). An interest-rate swap is an exchange of one interest rate for another in a given currency on a given notional principal. ("Notional" because the principal itself is not exchanged at any point, only the interest payments on the principal are.) For example, one counterparty in the swap may make floating-rate payments indexed to Libor, while the other makes fixed-rate payments on the same principal amount. Such swaps enable converting an exposure to one interest rate (e.g., floating rates) to another (e.g., fixed).

Swaps may also be used to exchange interest-rate exposure in one currency for interest-rate exposure in another currency ("currency swaps"). In a currency swap, the principal is not notional; rather it is exchanged at the beginning of the swap and re-exchanged at the end of the swap. This makes the currency swap effectively an exchange of loans between the two counterparties.

Other forms of swaps include equity swaps, which facilitate the exchange of equity exposure for interest-rate exposure (or for another equity exposure); commodity swaps which typically involve the exchange of the difference between a specified fixed price and the actual floating price of a commodity (e.g., oil); and credit swaps of various forms, such as total return swaps and credit default swaps. Swap uses are discussed further in Section 3.

A.4 Options

Forward contracts are characterized by *commitment* to the trade/exchange of cash flows specified in the contract, as are the contract forms descended from forwards such as futures and swaps, In contrast, options, as the name suggests, are characterized by *optionality*. A typical option

contract specifies the terms of a future trade, but in an option, one party to the contract retains the right to enforce or opt out of the contract.

- In a *call option*, the holder of the option has the right, but not the obligation, to *buy* the underlying asset at the price specified in the contract (called the "strike price").
- In a *put option*, the holder of the option has the right to *sell* the underlying asset at the specified strike price.

The investor holding the right in the option contract is variously referred to as the *buyer* or *holder* of the option or as the *long* position in the option. The other counterparty in the option trade—who has an obligation to take part in the trade specified in the contract if the option buyer should decide to exercise his right—is also called the *seller* or *writer* of the option or the *short position* in the option.

Option payoffs are non-linear in the price of the underlying. As an example, consider a call option that gives the buyer of the option the right to buy 100 ounces (oz.) of gold on March 3 at a price of $1,800 per oz. If the price of gold on March 3 exceeds $1,800 per oz. (say, is $1,840 per oz.), the buyer will exercise his right in the contract and buy the gold at the strike price of $1,800 per oz. Since the contract is for 100 oz., the buyer gains $4,000, and the seller is correspondingly out $4,000. However, if the price of gold on March 3 is less than $1,800 per oz., the buyer will choose to not enforce the contract, and to buy the quantity of gold desired directly in the market directly at the lower market price. Thus, the option holder can profit, but cannot lose, from the exercise decision. In exchange for taking the opposite side of the contract, the buyer of the option pays the seller an up-front fee called the option price or the option "premium.[20]

A.5 Credit Derivatives

Conventionally, finance distinguishes between *market risk* (the risk of changes in prices of various sorts—commodity prices, equity prices, index levels, exchange rates, interest rates, etc.) and *credit risk*, the risk that promised payments will fail to materialize. Market risk may be handled by the conventional derivative forms described above. For example, a forward contract may be used to insulate cash flows from the effect of changing prices; an option may be used to obtain a floor or ceiling price.

[20] In contrast, there is no up-front fee to enter into a forward or futures contract. There may be the posting of collateral (or "margin," as it is called in the futures context), but the collateral usually earns interest at a competitive rate, so there is no *economic* cost to the collateral posting.

Credit derivatives are a relatively recent class of products designed to hedge or mitigate credit risk. They were first introduced in 1993, but have grown very rapidly since then, and are now the third-largest segment of the derivatives market in terms of notional outstanding, behind interest-rate derivatives and currency derivatives (see Section 2).

By far the most popular form of credit derivative is the *credit default swap* (CDS). A CDS is akin to insurance against default on a specified "reference obligation," which could be a loan or bond issued by a corporate or sovereign. The buyer of protection in a CDS makes a regular periodic payment (called the CDS "premium") to the seller of protection. The payments continue until maturity or default on the reference obligation, whichever comes first. In exchange, if there is a default on the reference obligation, the protection seller undertakes to make the buyer whole by making a payment equal to the loss-given-default on the reference obligation.

In effect, the buyer of protection has a short position in the credit risk of the reference obligation (one that increases in value as credit risk deteriorates) while the seller of protection has a synthetic long position in the credit risk (i.e., an exposure to the credit risk of the reference obligation even without owning the obligation). CDSs can be used by banks and other financial institutions to hedge the risks of loans and bonds the institutions hold. They can also be used for *speculative* purposes: an investor who has no exposure to the credit risk of a reference instrument but who believes the credit risk will deteriorate can buy protection on the instrument and look to profit if the view materializes. Indeed, while the initial market in CDSs was motivated by considerations of hedging, in many countries, CDSs have become today the primary instrument of choice for taking on exposure to credit risk. In many ways, the CDS market is more liquid than the market for the underlying credits.

CDS indices are indices created out of credit default swap prices in a manner similar to the creation of equity indices out of equity prices. There are two major families of credit indices, the iTraxx indices which cover Europe, and the CDX indices which cover North America and Asia. About three-quarters of the credit derivatives market is composed of trading in CDSs and the CDS indices.