EDUCATIONAL NOTE

MANAGEMENT, RISKS, REGULATION AND ACCOUNTING OF DERIVATIVES

CHAPTERS 1-4
BIBLIOGRAPHY
GLOSSARY

COMMITTEE ON INVESTMENT PRACTICE

MARCH 1996

Cette note est disponible en français

Canadian Institute of Actuaries **Institut Canadien des Actuaires**

MEMORANDUM

To: All Members of the Canadian Institute of Actuaries

From: R.J. Sharkey, Chairperson
Committee on Investment Practice

Date: March 29, 1996

Subject: **Educational Note on the Management, Risks, Regulation and Accounting of Derivatives**

This note provides a review of derivatives, their prudent management, their risks and regulatory and accounting requirements. The note is intended to provide a broad framework and detailed review of management issues arising from the use of derivatives. A glossary and bibliography is included.

Questions regarding the note can be addressed to me at my *Yearbook* address.

The table of contents refers to chapters 5-9 which are not included on this document. Chapter 5 is available on request from the Secretariat of the CIA in the form of an ***Educational Note on Asset and Mortgage-Backed Securities***. Chapters 6-9 are available on request from the Secretariat of the CIA in the form of an ***Educational Note on the Nature and Uses of Derivatives***.

RJS

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* Published with Chapters 6-9 Educational Note on Nature and Uses of Derivatives.

CHAPTER 1 – AN INTRODUCTION TO DERIVATIVES

1.1 The Nature and Variety of Derivative Transactions

Derivatives are financial contracts that change in value in response to changes in the value, or a component of the value, of one or more underlying assets, or index of assets, currency, commodity or interest rate. On-balance sheet investments such as asset-backed securities, mortgage-backed securities and collateralized mortgage obligations fall within the scope of this definition. However, derivatives are often thought of more narrowly as contracts such as forwards, futures, swaps and options, which do not involve the booking of assets or liabilities on the balance sheet. Traditional derivatives fall into four classes: foreign exchange, interest rate, equity and commodity. They may also be classified as over-the-counter or exchange-traded and forward type or option type.

Derivatives are used to manage portfolios, asset allocation, balance sheets and income statements, to facilitate borrowing and lending and to transfer price risk arising from fluctuations in the value of assets and liabilities considered separately or jointly.

The wide spread use of derivatives began in the 1970's with the introduction of foreign currency futures (1972), equity futures (1973), T-Bill futures and futures on mortgage-backed bonds (1975), T-Bond futures (1977) and currency options (1979). The real explosion of innovation and usage came in the 1980's, however, with the introduction of currency swaps (1980), interest rate swaps (1981), interest rate caps and floors (1983) and a whole plethora of futures and option contracts on a range of instruments and indexes.

Many types of derivatives are now available, and, in some cases, essentially the same type of derivative goes by several names. The more common types include interest rate and currency swaps, basis swaps and swaptions, caps, collars, floors, futures and options on bonds, stocks, stock indices, currencies and commodities, forwards and forward rate agreements, CMOs, IOs, POs and equity-linked notes. More recently, insurance, credit, property and tax derivatives have been developed.

1.1.1 Forward and Option-Type Contracts

Derivative contracts are of two basic types – forward-type contracts and option-type contracts. Forward-type contracts include forwards, futures and swaps. Option-type contracts include options, caps, floors, collars and options on forward-type contracts. The change in value of a forward-type contract is roughly proportional to the change in value of the underlying asset or index, whereas the change in value of an option type contract is not. These two types of contracts are the building blocks from which all derivatives are constructed.

Futures Contract

A futures contract is an exchange – traded, highly standardized contract obliging a buyer and a seller to trade at a set price on a future date during a specified delivery period, a fixed amount of a specified commodity, currency, specific financial asset or index. The future is a price-fixing contract, because the buyer takes on the financial consequences of owning the asset as soon as the future contract is established. The futures price quoted is the price to be paid at maturity in exchange for the asset.

A futures exchange is a central marketplace where futures contracts are bought and sold competitively and openly. All contract terms and conditions are specified by the exchange except the price. The standard terms and conditions of a futures contract make it very liquid and easy to trade. Contracts of the same maturity are identical and consequently can be traded anonymously.

A buyer of a futures contract, who holds it until expiry, is obligated to accept delivery of the underlying asset or index. The seller is committed to make delivery during the delivery period. Most futures contracts are settled in cash by extinguishing the contract prior to the commencement of the delivery period. This is done by buying an exactly offsetting contract from the exchange.

At the time the futures position is established, the investor is required by the exchange to put up collateral or margin equal to a small, specified percentage of the contract's face amount. This margin is a good faith deposit and not a down payment. The exchange defines the amount of this "initial margin." Every day thereafter, the investor will either pay or receive a "variation margin" equal to the change in price of the underlying asset or index times the face amount of the contract. This daily settlement means that the difference between the price of the underlying asset at contract initiation and maturity will be paid over the life of the contract.

Futures contracts can be used for a wide range of risk and business management purposes. Futures are useful in situations where there is a desire to defer asset transactions due to cash flow, liquidity, tax, market and other circumstances. They are also useful in situations as a substitute for asset transactions, which are blocked by legal, regulatory and contractual constraints or difficult due to a lack of expertise, resources and costs. More specifically, futures can be used to increase or decrease interest rate and stock market exposures, to implement asset overlay and replication strategies, and to hedge specific debt issues, liabilities and assets.

Suppose it is desirable to reduce interest rate exposure by selling $10 million par value of ten-year Canada bonds and holding cash. Suppose that a $100,000 par value of this Canada bond can be delivered to exactly satisfy obligations on one ten-year Government of Canada bond futures contract traded on the Montreal Exchange (The trading unit is $100,000). The sale of 100 such futures contracts will eliminate the undesired ten-year Canada bond interest rate exposure, since no matter how ten-year interest rates change, the $10 million of ten-year Canada bonds can be delivered in full satisfaction of the 100 contracts sold.

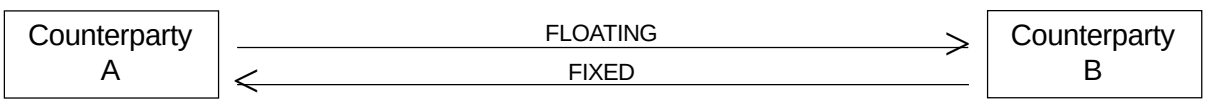
While this exact use of futures contracts is unlikely to prove attractive (since the sale of the Canada bonds is likely to be preferred), consider the situation where the unwanted ten-year interest rate exposure arises from an illiquid private placement providing an attractive spread over ten-year Canada bonds. The undesired interest rate exposure can be eliminated by selling the same 100 futures contracts.

Interest Rate Swaps

An interest rate swap is an exchange of one or more payments between two counterparties, at specified times, for a specified period of time. The payments are calculated as a percentage of a principal amount according to the swap agreement. The principal amount is not an obligation of either party. It is simply the basis on which payments are calculated. At the end of the swap term, payments simply cease. Since the principal amount is typically not exchanged, this amount is referred to as the notional principal amount.

The size of the notional principal amount can range from one million to billions of dollars and the term from one to 50 years. Swaps are highly liquid up to five years and increasingly illiquid and infrequent beyond ten years. Since swaps are over-the-counter instruments, they can be designed to exactly fit the needs of the user.

Interest Rate Swap



In a typical swap, counterparty A agrees to make periodic floating rate payments for the term of the swap to counterparty B in return for the receipt from B of periodic fixed rate payments. The floating rate is determined by a market index such as three-month banker's acceptance rates. Floating payments are made at the end of each period based on the floating rate at the beginning of the period.

Interest rate swaps can be used for a wide range of risk management and business purposes to increase or decrease interest rate exposure (duration); to hedge specific balance sheet assets and liabilities; to expand investment and marketing opportunities and to manage an asset portfolio.

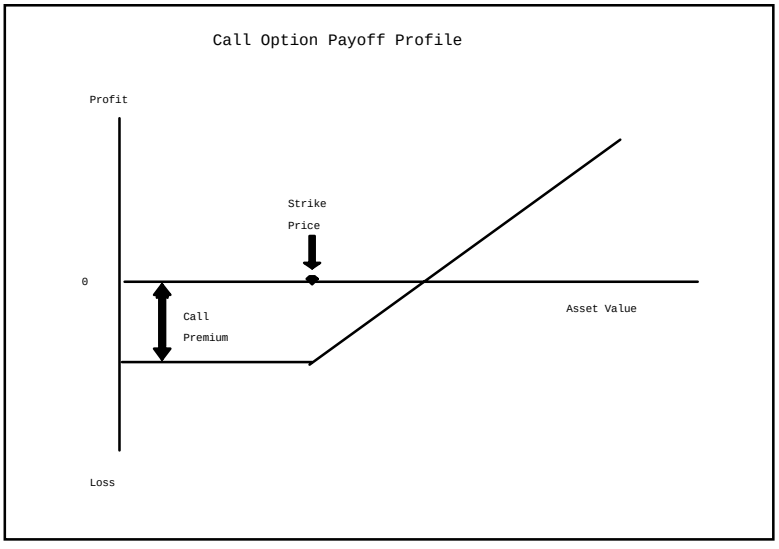
Suppose it is desirable to reduce interest rate exposure by selling five-year bonds with a coupon and yield of 8% and to purchase, with the proceeds, five-year term floating rate bonds paying three-month banker's acceptance rates, reset every three months. Instead of implementing the bond switch, an interest rate swap can be entered into to pay a fixed rate of 7.5% for five years in exchange for the receipt of a three-month floating rate based on banker's acceptances. The combined cash flows from the 8% bond and 7.5% fixed pay swap is the receipt of BAs plus .5% (swaps receipt at BAs plus bond coupon at 8% less swap payment at 7.5%). The undesired interest rate exposure to five-year rates has been eliminated by the swap at a .5% advantage, relative to the bond switch alternative.

Options

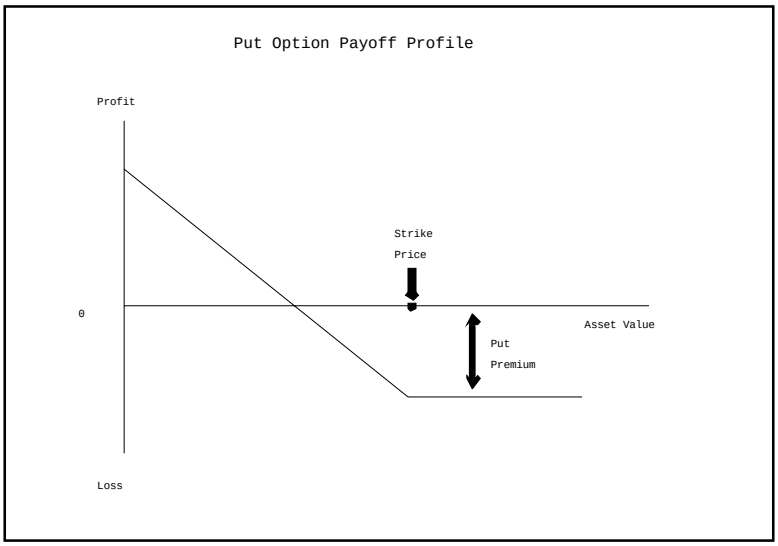
An option is a contract in which the buyer pays a fee (called a premium) in exchange for the right, but not the obligation, to buy (a call option) or sell (a put option) a fixed amount of a specific commodity, currency, swap, futures contract, financial asset or market index at a set (strike) price within, or at, a specified time.

An option may be exchange-traded, with standard terms, or over-the-counter, with terms negotiated directly between the two parties. The amount that can be purchased/sold by exercising the option is the "face amount" of the contract. The premium paid is usually a small fraction of the face amount.

Options terminate through their exercise, expiration or through an offsetting option purchase or sale (closing transaction). Options settle upon exercise through delivery of the underlying asset or index or through cash settlement of the difference between the strike price and the asset value. Options on indices almost always specify cash settlement. Options on single stocks usually have physical settlement.



When the asset value is less than the strike price, the call option expires worthless and the payoff is a loss equal to the premium paid. When the asset value exceeds the strike price, the payoff is the gain in value of the asset over the strike price (dollar for dollar) less the premium paid. The payoff profile is one-sided, since the downside is truncated.



When the asset value is greater than the strike price, the put option expires worthless and the payoff is a loss equal to the premium paid. When the asset value is less than the strike price, the payoff is the amount by which the asset value has dropped below the strike price (dollar for dollar) less the premium paid. The payoff profile is one-sided, since the downside is truncated.

To hedge a position against losses from an increase (decrease) in rates, a put (call) option on a bond of appropriate term would be purchased. The put (call) option increases in value with increases in rates above (below) the rate equivalent to the strike price on the option. These option gains hedge the losses on the position hedged arising from rate increases.

To hedge a stock portfolio that is highly correlated with the TSE 300 against a decline in value, put options could be bought on the TSE 300 index. Should the index decline in value, below the put strike price, the put option will increase proportionately in value. Assuming the amount of puts purchased bought protection for the entire portfolio and that the portfolio loses value to no greater extent than the index, the gains on the puts will offset the losses on the portfolio.

Forward-Type Contracts Versus Option-Type Contracts

Any position or risk can be hedged using forward-type contracts or option-type contracts. The forward-type contract requires the hedger to forego the upside potential of the hedged position, or equivalently, exposes the hedger to losses on the forward contract. The option-type contract is a more costly form of hedging, but it allows the hedger to keep the upside potential of the hedged position. The future-type contract is used in “market-neutral” hedging. An option-type contract might be chosen, if the hedger is prepared to pay the price for the opportunity to simultaneously hedge against the downside and take a position on a market view.

Much of the innovation and complexity of option-type contracts is a result of efforts to reduce option costs, while providing the end user with the flexibility to choose precisely how much upside potential to retain. With the option-type contract, the hedger must not only decide the amount, timing and duration of the hedge as with a forward-type contract, but also must decide the appropriate set of option features, chief amongst which is the strike price. The option premium is often not paid up front, but may be paid instead at the exercise date, or in the form of an annuity or a contingent annuity.

Sometimes the premium paid is reduced by the premium for an option that the purchaser sells to the counterparty. The use of option-type contracts in hedging requires close monitoring of the impact of the passage of time and changes in price volatility and interest rates on the hedged position.

The market risk of a forward-type contract is measurable in terms of symmetric measures of risk such as standard deviation, in much the same way as the underlying asset or index. However, an option-type contract truncates the return distribution (see the payoff profile graphs) and asymmetric measures of market risk are required (e.g., semi-variance and shortfall risk).

Option-type contracts create unilateral credit risk. The seller is not exposed to credit risk, since the only obligation of the purchaser to the seller is the premium, which is usually paid at contract inception. Forward-type contracts involve bilateral credit risk. Both buyer and seller can be exposed to credit risk depending on price movements in the underlying asset or index.

1.1.2 Exchange-Traded Versus Over-the-Counter Derivatives

Derivatives may be exchange-listed, standardized contracts such as Canada bond futures or stock options. Derivatives transacted off organized exchanges are referred to as over-the-counter. Over-the-counter arrangements use customized contracts in which parties to the contract negotiate all terms and conditions.

Size and Flexibility

A large size exchange-traded derivative transaction may be difficult to execute, but a large size over-the-counter derivative transaction is usually possible. Smaller size exchange-traded transactions are usually easier to execute than small size over-the-counter transactions.

Exchange-traded derivatives are inflexible, since the choice of the underlying asset, or index, the maturity, the contract size, delivery terms and other conditions of the contract are established by the exchange. Over-the-counter instruments are custom designed to meet the precise usage required. Typically, there is more flexibility as to the financial terms, such as size and length of time to maturity, and the underlying asset or index, than would be available from exchange-traded instruments.

Exchange-traded transactions provide only a limited array of derivative types and contract terms, which may not fully meet hedging requirements as to timing and amount. Over-the-counter arrangements can be more cost-effective, can fit hedging requirements more precisely and can benefit from the advice and expertise of the market maker.

Pricing

Current market prices are generally readily available for exchange-traded derivatives, since obtaining and disseminating this information is a responsibility of the exchange. Market prices for over-the-counter derivatives may be difficult to obtain.

The standard nature of exchange-traded contracts and the protection of users from the risk of dealing directly with counterparties can make these contracts highly liquid and price competitive. The negotiated terms and conditions of over-the-counter derivatives may make them less liquid and less competitively priced than exchange-traded derivatives. However, liquidity and price competitiveness varies by contract type and some exchange-traded derivatives are quite illiquid and have low volume and some over-the-counter derivatives are quite liquid and competitively priced.

Over-the-counter derivatives will be less competitively priced than exchange-traded derivatives to the extent that the over-the-counter derivative is complex, unusual or innovative, and, consequently, only available from a single or limited number of counterparties. The dealer will be in a position to charge handsomely for innovation, for the capacity to dynamically manage, measure and monitor complex risks and for the prospects that capital may be put at risk during the life of the contract.

Credit and Legal Risks

Credit risk applies to financial instruments in that the counterparty may not make good on the full financial terms of the contract. Over-the-counter products are subject to counterparty risk. There are growing concerns that some market participants do not have appropriate risk management capabilities and do not have an acceptable level of capital for the risks involved. Counterparty risk with over-the-counter instruments may be somewhat mitigated by mark-to-market settlement arrangements, by the provision of collateral and by guarantees provided by a parent or other high credit quality institution.

Exchange-traded products have an advantage over over-the-counter products by the fact that daily marking to market and counterparty guarantees of clearing by the exchange substantially reduce credit risk. The exchange will make good any default, unless the exchange exhausts the total margin on deposit and the total capital of the exchange, and its members are unwilling to support the exchange further.

The legal documentation governing an exchange-traded derivative is provided by the rules and regulations of the exchange and any contract with the broker. Exchanges are subject to extensive regulatory supervision and legal requirements. The contract signed by the counterparties, (usually an ISDA master agreement) provides the legal documentation for over-the-counter derivatives. Over-the-counter markets are largely unregulated and involve a higher degree of legal risk than exchange-traded vehicles.

Liquidity Risks

The liquidity of over-the-counter instruments may be quite limited. Over-the-counter derivatives cannot be traded like exchange-traded derivatives. However, they can often be unwound or assigned with the agreement of the original counterparty. A significant illiquidity premium may need to be paid if the derivative is especially unusual, complex or long term, or markets are especially volatile and chaotic.

The size of the illiquidity premium can be a critical consideration, if the contract might need to be unwound or assigned prior to its maturity. The cost of closing out a contract is an especially critical consideration, if the instrument might need to be unwound or assigned quickly, because it is subject to rapid adverse price changes under certain circumstances. Usually, liquidity evaporates in these situations and the instrument cannot be unwound in a timely fashion, while the price continues to deteriorate. Indeed, the original counterparty may not even be prepared to close out the contract, unless this right has been negotiated in the original contract.

Margin deposits and mark-to-market cash settlement on exchange-traded instruments require a liquidity account and may contribute to increased earnings volatility and cause adverse tax consequences. These can be largely avoided with over-the-counter contracts.

1.1.3 Structured Investments

Structured investments combine a cash-market security (debt or equity) with a derivative. They come in endless variety and are frequently used to gain market exposure that is constrained by regulation, taxes, liquidity, etc.

Structured notes embed a derivative in a bond. Callable, puttable, exchangeable and extendable bonds and convertible bonds, which give the option to the investor to convert into stock at a fixed conversion price, satisfy this definition but are usually not referred to as structured notes. A medium-term note is a structured note that provides return of principal and/or interest indexed to the change in, or return from, a given currency, commodity, market index, yield curve or interest rate relationship. Returns may be positive or negative.

Structured notes were sold in large volumes starting in 1990. Sales exceeded $80 billion U.S. in 1993 and the outstanding volume reached $200 billion U.S. by early 1994, when the Fed first began raising rates.

Principal guaranteed notes are medium-term notes that come with a full credit obligation of the issuer to return the principal amount at the end of the term. Any additional payment is the greater of zero and some participation percentage of the change in a specified index during the term of the note. The note may provide for minimal periodic fixed rate payments with a corresponding reduction in the participation percentage. The participation percentage may be greater for increases in the index beyond some specified level.

The participation percentage in a medium-term note may be more or less than 100%. If the index is a stock index without dividend, then the percentage would exceed 100% in compensation for the foregone dividends. If the index is in a foreign currency and the payoff is defined in relatively weaker local currency terms, forward currency rates may imply a participation percentage significantly greater than 100%. A higher participation percentage than 100% will often apply in the case of the Canadian currency, which is weak, relative to most major foreign currencies.

Structured notes can be used to embed almost any type and magnitude of exposure in an investment that will at least superficially satisfy the constraints placed on a portfolio. For example, a fund restricted to investments with maturities of two years or less could use a two-year structured note to place a leveraged bet on rate changes at any point along the yield curve and on changes in the shape of the yield curve, or even changes in yields in two different currencies.

An inverse floating rate note is an example of a “yield curve” note. This is a bond with a coupon equal to a fixed rate less a floating rate or some function (possibly leveraged) of one or more floating rates. Usually, it is specified that the rate paid cannot drop below zero. Other variations involve price changes or yields on constant maturity bonds in place of the fixed rate. Notes paying a multiple of a floating rate less a fixed rate are also available.

Range floating rate notes accrue interest at an enhanced rate (say, 40% above the current two-year rate) on each day that the floating rate index, LIBOR, say, falls in a fixed range of rates and accrues interest at an unattractive rate (say, zero), otherwise. A yield curve spread note has a coupon that is a function (possibly leveraged) of the difference in yields on two points on the same yield curve or two yields in different currencies.

1.2 The Size of the Derivatives Market

Measures of Transaction Volume and Credit Risk

The size of the derivatives market or a company’s derivative exposure is frequently expressed in terms of the dollar amount of the underlying asset or index to which the derivative is linked (the “face, contract or notional principal amount”). This can lead to some very large and potentially misleading measures of market size or exposure. Such measures are measures of derivative transaction volume only. They are not measures of the risks created in the market or taken on by the company.

The risks of derivatives are linked directly to the size and price volatility of the cash flows the derivatives occasion and only indirectly to the size of the underlying asset or index. Derivative risks are frequently offsetting and the potential risk of loss varies considerably across the range of derivative products for the same notional amount. Measures of market size based on the dollar amount of the underlying asset or index do not reflect the netting of risk nor variations in the potential for risk across different types of derivative transaction.

Gross replacement cost (calculated by marking the derivative contract to market) is a measure of risk exposure commonly reported. It is the amount that would need to be paid to replace the existing contract with a new identical contract. Gross replacement cost does not reflect legally enforceable netting arrangements with single counterparties and the potential for future losses. It also takes no account of the probability of default of a counterparty, the fact that not all counterparties will default at the same time and that some amounts are likely to be recovered in the event of default.

The Bank for International Settlement (BIS) established a measure for derivative credit risk exposure in 1988 that is used in setting bank capital requirements. The BIS measure equals the gross replacement cost of the derivative contract plus an "add on" for potential future exposure over the remaining contract life. See Section 2.2.4 for details. The measure as amended does take some account of netting of offsetting exposures, but it is still relatively crude and reflects the relative differences in price volatilities of the underlying asset or index to only a very limited degree.

The derivatives market has grown exponentially to an awesome size. In the period 1987-1992, interest rate swaps grew at a 33.4% rate, currency swaps at a 29.4% rate and U.S. exchange-traded interest rate and currency futures at a 22% rate in terms of notional amount. In 1992, $3.1 trillion of new swaps were originated and $140 trillion of exchange-traded futures and options were traded worldwide.

Worldwide, the derivatives market, as of 1992 year-end, is estimated by the U.S. General Accounting Office (GAO) to have notional principal amount of $17.7 trillion U.S. Over-the-counter derivatives are about $12.9 trillion and exchange-traded about $4.8 trillion U.S.

Over-the-counter derivatives are estimated by the GAO to be: foreign exchange forwards and options ($5.5 trillion), interest rate swaps ($3.9 trillion), forward rate agreements ($2 trillion), interest rate options ($.6 trillion), currency swaps ($.9 trillion). Caps, collars and floors are estimated to be ($468 billion), and swaptions ($108 billion). Exchange-traded derivatives are estimated to be: interest rate futures ($3 trillion), interest rate options ($1.4 trillion), equity index options ($.3 trillion) and currency options, equity index futures and currency futures about $.1 trillion each. Mortgage derivatives and structured notes are estimated to be $710 and $250 billion, respectively. Index-amortizing swaps are estimated to be $150 billion.

At year-end 1994, the notional principal exposures in U.S. commercial banks was $15.6 trillion according to the Comptroller of the Currency. Major exposures were: Chemical Bank 3.2 trillion; Citibank $2.6 trillion; Morgan Guaranty Trust $2.4 trillion; and Bankers Trust $2.0 trillion. At year-end 1993, other exposures were: Salomon Inc. $999 billion and Merrill Lynch $891 billion.

The aggregate gross replacement cost exposure for U.S. commercial banks at year-end 1993 was about $143 billion. About 94% of this was concentrated in the 10 largest bank exposures. The BIS add-on for potential credit exposure was about $60 billion.

On average, the major U.S. banks have gross replacement cost exposure equal to 2.3 times their capital. At year-end 1993, exposures were: Bankers Trust 585%; J.P. Morgan 376%; Chemical Bank 255%; and First Chicago 207%. At year-end 1992, Citicorp, Chase Manhattan and Salomon Inc. had exposures between two and three times their equity.

Canadian Bank Derivative Exposure
April 30, 1994

	Notional Principal Amount	Gross Replacement Cost		BIS Credit Risk Measure	
	$ Billions	$ Billions	% *	$ Billions	% *
CIBC	$ 769	$ 10.4	162%	$ 15.2	237%
Royal Bank	846	9.3	155	14.7	246
Bank of Nova Scotia	405	6.8	139	10.1	207
Bank of Montreal	384	5.3	103	8.4	165
Toronto Dominion	376	5.5	114	8.2 #	169
National Bank	76	.5	28	.6	37
Total	$2,856	$ 37.8	131%	$ 57.3	198%

Estimated.

* Corresponding amount as a percentage of common equity.

Variations in the relative amounts between gross replacement cost and the BIS credit risk equivalent reflect variations in the potential credit exposure across different derivative products.

The notional principal amounts of the six major Canadian banks have increased at an average annual rate of 30% in the five years to 1994. At the end of 1993, the notional principal amount of currency swaps with the now insolvent Confederation Life and Confederation Treasury Services Ltd. was just under $4.3 billion and of interest rate swaps was $9.1 billion.

The Bank of Canada did a study of the Canadian wholesale derivatives market covering 23 banks and 16 other financial institutions for the fiscal year ending March 31, 1995. Details will be published in the *Bank of Canada Review* winter issue.

(Billions U.S. $)

	Foreign Exchange	Interest Rate	Equity	Commodity
Nominal	693.7	1,113.0	10.5	9.2
Market	29.0	15.2	0.4	1.5

Forwards and foreign exchange swaps accounted for 81%, currency swaps for about 12% and options and futures for the balance of foreign exchange derivatives. Currency swaps are for about 12% and options and futures for the balance. Swaps accounted for 46%, futures for 31%, forward rate agreements for 12% and options for 11% of interest-rate derivatives. Options accounted for 64% of equity and 75% of commodity derivatives.

1.3 Derivatives: Risk Or Opportunity

Derivatives are valuable risk management and efficient portfolio management tools. While there have been a number of notable problems (see Section 2.1) at individual companies, the current relatively unregulated system has performed well to date. In spite of their current notoriety, it should be stressed that derivatives do not introduce risks of a fundamentally different kind, or of a greater order of magnitude, than those already present in cash markets.

There are problems with the lack of uniformity, clarity and appropriateness of accounting, regulation and laws, the level of understanding of derivatives and their risks present on boards and senior management and the adequacy of internal risk management policies and controls. The avoidance of problems with derivatives can best be accomplished with an enlightened regulatory, legal and accounting environment, prudent investment policies and an informed management and board. With these ingredients, derivatives can prove of fundamental value to financial institutions, capital markets, investors and borrowers.

Derivatives are dangerous in the same way that fire and creativity are dangerous. They can be used to prudently manage risk on the one hand or they can be used imprudently to excessively leverage risk.

While derivatives present many potential risks, perhaps the greatest risk to a financial institution or financial industry is to underuse them as risk and portfolio management tools in the face of persistent risks that cannot be managed cost effectively in any other way. For example, derivatives, such as interest rate swaps and mortgage-backed securities, could have gone a long way to reduce the duration mismatch of the savings and loan institutions in the 1970's and early 1980's. To the extent that derivatives are used prudently and are cost-effective, the failure to use them may ultimately lead to declining market share and shareholder or company value.

Derivatives Are Not A Zero-Sum Game

The exponential growth of derivatives is the result of many factors. These include the globalization of capital markets; the perception of increased volatility in currency, interest rates and commodity markets; the desire to leverage capital; the growing emphasis on asset/liability management; the exponential growth in retirement savings to which interest rate guarantees are attached; the technological advances in computers and telecommunications and pressure on banks and dealers to find new sources of profit as traditional activities are eroded by capital market developments. Fundamentally, however, the use of derivatives has exploded because derivatives have been recognized as making good financial sense by a large and diverse group of users.

Derivatives are not a zero-sum game as has sometimes been alleged. By promoting the modification and repackaging of cash flows and the disaggregation of risks into their component parts, derivatives promote the sale of cash flows, by those not in a position to give them their highest value, to those who are. Derivatives promote the raising of capital and the sale of risk exposures at the cheapest price. Companies can mitigate the financial impact on their business of essentially extraneous price fluctuation by fixing the price of future purchases and sales and future exchange rates. In this way, derivatives bring about a fundamental improvement in the availability of capital, the liquidity and pricing of assets and the diversification of risk. The efficiency of capital markets and the soundness of financial institutions are thereby enhanced.

Derivatives are used to facilitate borrowing, lending and treasury functions. Derivatives can add value to debt management by enabling capital to be raised at a lower after-tax cost, by improving access to capital, by increasing the flexibility and tax efficiency of the corporate debt structure, by enabling the pursuit of funding opportunities at the most opportune times and in the most advantageous capital markets, by enabling the optimization of the debt maturity and currency profile and by assisting in the management of debt to equity and interest coverage ratios.

The investment and risk management use of derivative instruments generally falls into one or the other of the categories: to reduce risk (hedging), to manage risk (portfolio management) or to assume "naked" risk (speculation). In hedging and portfolio management, derivatives are used to solve problems created by an already existing portfolio or balance sheet. These uses should be contrasted with the stand-alone, speculative use of derivatives.

In general, it cannot be presumed either that derivatives are costly or that they are the most cost-effective tools. This is a matter of fact that can only be determined by comparing the costs of using derivatives to the cost of the best cash market solution.

In many cases, the risk exposures arise in the retail markets in which the financial intermediary operates. Derivatives enable the financial intermediary to arbitrage between wholesale markets and retail markets. The supply/demand forces shaping the wholesale markets can lead to attractive opportunities to address problems arising from the quite different supply/demand forces shaping the retail markets.

Usually cash market alternatives are available, but they may not meet the precise need required. A large cash flow deficiency in 37 months creates a very precise interest rate risk exposure that may not be manageable through the purchase of 37-month zero-coupon bonds, say. However, an interest rate swap could meet this precise need.

The Speculator/Hedger Model of Derivative Markets

The use of derivative instruments to transfer risk might be expected to involve material and potentially prohibitive costs. On this model, the derivatives market consists of hedgers, who have excess risk that they pay to transfer to speculators, who have the capital resources to assume the risk for a price. According to the speculator/hedger model, the financial intermediary takes on risk from its clients and lays this risk off on speculators using derivatives, much in the way reinsurance or syndication works. There is a price for laying off this risk and this price is presumably commensurate with the price charged to clients.

Even on this speculator/hedger model, derivatives play a cost-effective function as an efficient mechanism for relieving unwanted concentrations of risk in financial intermediaries. A financial intermediary takes on risks in a retail market at retail prices, nets many of these risks against offsetting risks, absorbs that level of risk commensurate with its level of capital and risk tolerance and sells any excess risk in the wholesale market, at wholesale prices.

On this speculator/hedger model, the cost-effectiveness arises because of the difference in the retail and wholesale pricing of risk and because costs are incurred only at the margin and only after the netting of offsetting risks. The use of derivatives to reduce risk will be much more cost-effective than traditional pricing and marketing approaches, for example, since these latter approaches frequently do not incur costs only at the margin. It is not evident, on this model, however, how the use of derivatives can be more cost-effective than cash market alternative strategies.

The Market Maker Model of Derivative Markets

The speculator/hedger model of the derivatives market is extremely limited in its application. The real efficacy of derivatives as a risk management tool arises from the fact that it facilitates the netting of offsetting risk positions across financial institutions, financial market participants and financial markets. Investors may have reciprocal risk positions that they can exchange. The costs of a derivative transaction may, in fact, be relatively modest if the risk can ultimately be transferred to a party that is well-positioned to absorb the risk.

Insurance company A might need to reduce asset duration, while insurance company B might need to increase asset duration. The two companies could transact in the cash markets with company A selling its excess assets to company B. However, company A may wish to retain all its assets for portfolio, tax or other reasons and company B may not have the cash needed to make the purchase. What the two companies really want to do is buy and sell interest rate exposure.

The buying and selling of interest rate exposures is precisely what the derivatives market is designed to facilitate. Company A could enter into a $10 million interest rate swap with company B, whereby it agrees to pay an appropriate fixed rate for 10 years in exchange for a floating rate that varies every three months and is based on short-term money market rates. Effectively, company A has sold an exposure to 10-year interest rates to company B and purchased an exposure to short-term rates from company B. And there is no need to presume that a speculator is lurking in the process seeking to charge an exorbitant rate for putting at risk the speculator's limited and valuable capital.

In practice, company A and B are not likely to luck upon each other, and to be able to transact directly. Derivative market makers facilitate the process by buying an exposure from one party and selling it to another. A relatively small transaction charge for facilitating the transaction is charged by the market maker. The size of the charge will depend on how readily the market maker can lay off the exposure, since the market maker does not plan on retaining the exposure (unless it happens to fit with a desired trading position). The exposure will be broken into its component parts and netted against all other exposures. Only then will the market maker need to consider laying off the risk externally.

The market maker enters into a huge volume of derivative transactions across the full spectrum of end users from individuals, corporations, financial institutions, pension funds, mutual funds, governments and central banks. And global market makers will deal with end users crossing international, regulatory accounting and tax jurisdictions. This will mean most exposures can be netted without putting capital at risk or incurring costs by laying off the risk with other market makers.

With complex, innovative derivative transactions, the transaction cost can be substantial, since the market maker will charge for its innovation, for the complexity of monitoring, measuring and netting the risk on a dynamic and continuous basis and for the likelihood that some of its capital will be put at risk for some period of time. With simple, high volume transactions, however, these factors do not apply and the transaction cost will be minimal.

The New Investor Model of Derivative Markets

If the risk is transferred from one financial intermediary to another financial intermediary participating in the same market and subject to the same risk management problems, then the risk transfer costs can be expected to be substantial. However, derivatives can facilitate the entrance of new participants into the market place. The process is not a closed loop. In the case of mortgage-backed security (MBS) issuance, for example, the risk to a financial intermediary caused by excess five-year mortgages is transferred to a new party, the MBS investor, who finds the MBS government guarantee, even with the narrow MBS spread over government bonds, attractive.

This new participant in the process is happy to absorb some of the over supply of five-year mortgages and, thereby, relieve some of the market-based term mismatch problems of financial intermediaries. This new participant helps keep costs of risk transfer to a minimum.

In general, securitization serves to bring new investors into the market for the asset securitized. These investors have no interest in, nor capability of, sourcing and evaluating the assets securitized (auto loans, card receivables, residential mortgages, etc.) and no interest in, nor capability of, servicing and administering these assets. The illiquidity of the securitized asset may be unacceptable to the investor. Securitization removes these incidental obstacles to ownership, creating liquidity, investment and risk management opportunities.

The simplicity and liquidity of interest rate swaps combine to make them an extremely cost effective risk transfer process. Cross currency arbitrage in the swap markets means that, in effect, the entire financial world can participate in the Canadian swap market. For example, Canadian dollar fixed-rate Eurobonds will be issued along with Canadian dollar interest rate swaps to float the debt, if the

Canadian fixed swap spread widens to attractive levels. This swap activity will put pressure on the swap spread to narrow. This discipline ensures that the supply/demand forces impacting Canadian swap rates are not entirely circumscribed by the big six Canadian banks.

1.4 Prudence Cannot Be Equated With Hedging

The first pitfall to avoid in developing prudent policies for managing derivatives is the misidentification of prudence with hedging. Hedging is neither a necessary nor sufficient condition for prudence.

Speculative use of derivative instruments by financial institutions or pension funds is generally prohibited by regulators and is especially open to the charge of imprudence. Typically, the losses incurred by speculative uses may be several times the initial investment, which is inconsistent with the goal of capital preservation usually associated with prudence.

There is usually nothing intrinsic to a derivative instrument contract that establishes that the transaction is being used in a nonspeculative way. Viewed in isolation, the use of the contract will usually appear to be speculative and hence imprudent. Indeed, unless the use of the contract is part of a clear and comprehensive plan to efficiently manage and modify identified asset, liability and balance sheet risk exposures, it may well be speculation, in fact, if not in intent.

Because of the difficulty of distinguishing speculative from nonspeculative uses of derivative instruments, it has sometimes been maintained that only hedging of a specific asset or liability was nonspeculative. For example, all public accounting guidance material in the U.S. requires the link to a specific asset or liability to be counted as hedging. All other uses are branded, by default, as speculative. Indeed, unless the hedge is perfect as to the timing and amounts of the cash flows, the hedge is sometimes regarded as impure and hence somewhat speculative.

While hedging a specific asset or liability is a clear and important nonspeculative use of derivative instruments, it is far too restricting to draw the line in this way. There are many uses that are neither specific hedges nor speculation. In particular, derivatives can be used to reduce aggregate portfolio and balance sheet risks and this is hardly speculation.

If nonspeculation is equated to hedging, then all the myriad difficulties surrounding what is and is not to count as hedging become critical to deciding whether something is prudent. It has been argued that anticipated transactions can be hedging only if the anticipated transactions are legally enforceable; that a transaction can be hedging only if it can be proven to reduce enterprise wide risk and that the use of derivatives to modify the undesired features of assets and liabilities is not hedging. Thus, the use of an interest rate swap to convert a floating rate bond to a fixed rate bond would not count as hedging. The exact level of correlation between the price changes of a hedged position and hedging instrument that is needed for a use to be accepted as hedging is unclear.

Another difficulty with an identification of prudence with hedging is the fact that many of the more notorious derivative losses arose from activity alleged to be hedging. Equating prudence with hedging will merely drive people to abuse language by calling all prudent uses hedging, even if they are not.

Insisting that all transactions must be hedges in order to count as prudent misdirects attention away from many critical aspects of prudence. Focusing on the actual nature and magnitude of the risks involved, the *bona fide* business purpose they serve, the oversight role of the board and senior management, the expertise and integrity of derivative traders, the systems and models for measuring and monitoring derivative activity and exposures and the internal controls and procedures is a more effective approach to prudence. A legalistic mandating of minimum requirements is unlikely to prove effective because of the innovative nature of the derivative market.

Perhaps the best approach to establishing a prudent risk management and control framework for derivatives is to extend the framework applied to cash market investments to derivatives. In this approach, derivatives would be subject to the condition that combined exposure to risk arising from direct asset holdings and derivatives is to be no greater than the risk exposure that is accepted, attainable and prudent from direct asset holdings. Use of derivatives, subject to this constraint, is no more speculative or imprudent than direct asset transactions entered into in the course of portfolio management. Indeed, this use of derivatives can be understood as providing alternatives that achieve similar risk exposures to those provided by direct asset transactions.

While using derivatives to increase risk is not hedging, by definition, this does not automatically imply that such usage is speculation or is in any way imprudent. The classification of all uses of derivatives as either hedging or speculation is an artificial dichotomy.

As an alternative to investing directly in the bond or stock market, for example, one could hold money market instruments and purchase bond futures or stock index futures, respectively. Alternatively, one could hold money market instruments and enter into interest rate swaps or equity swaps. In the equity swap, one would receive periodically the return on an equity index and pay periodically a fixed interest rate or a floating rate based on some floating interest rate index. This unleveraged method of increasing market exposure to the bond and stock markets can be regarded as an alternative to direct investments and not speculation.

In general, derivatives can be used to increase exposure to any risk. If the increase in risk is no greater than that which is deemed prudent through direct cash market investment, the use of derivatives should not be labelled speculative.

In this framework, derivatives can be used prudently as a substitute or alternative strategy to direct cash markets and can be used prudently in portfolio and asset/liability management, asset allocation, debt, capital and treasury management. They can also be used to modify undesired features of assets and liabilities and to earn enhanced returns as with covered option writing.

1.5 Differentiating End Users from Market Makers

A second pitfall to avoid in developing best practices for derivatives is to presume that the best practices for all users of derivatives should be based on the best practices followed by those who are the most active derivative players (i.e., the market makers). Early surveys of best practices and early regulatory guidelines for best practices made this incorrect, but not unnatural presumption. Best practices for end users are not merely watered down versions of those for market makers.

The risk exposures of a derivatives market maker are materially greater than those of a typical end user. However, best practices of the end user will differ from those of market makers, not just in extent, but primarily in the ways and context in which derivatives are used.

The derivative portfolio of a market maker can be understood and analyzed on a stand alone basis. Attempts to understand and analyze the use of derivatives by end users on a stand alone basis are meaningless and perverse. Capital allocation, risk measures, stress testing, disclosure and best practices can be applied directly to the market maker's derivative portfolio, but not to that of the end user.

Emphasis on the complex, mathematical risk measurement techniques essential for the market maker may distract the end user from the straightforward policy and control issues that lie at the foundation of many of the losses suffered by end users. Basic controls, and not sophisticated models, would have prevented many, if not most, end user losses.

Best practices, for the end user, should emphasize those requirements which will ensure that derivatives receive appropriate oversight from the board and senior management and that derivatives usage is appropriate to the end users circumstances. By emphasizing the market maker perspective, regulatory guidelines for best practices may pay insufficient attention to those practices that deal with suitability issues. And yet, this should be central to the end user.

Differing Objectives and Framework

End users differ from market makers, not just in the material nature of their derivatives transactions volumes, but also in their operations and how they are used. For the typical end user, derivatives represent a solution to a problem, whereas for a market maker, they represent an opportunity to earn a profit. End users mainly employ derivatives to achieve financing or capital management objectives, or to manage the risk/return tradeoffs of portfolios and balance sheets. Dealers hold inventories and provide transaction services to end users, in order to generate income from transaction fees, bid/offer spreads and position taking.

End users operate within a framework defined by the relationship between a portfolio of assets and a block of liabilities. Market makers operate in a framework defined by an objective to maximize transaction volume and trading profits, subject to position limits and their ability to price profitably and to manage the ensuing risk. Consequently, the risks and best practices for end users are not necessarily aligned with the risks and best practices of dealers.

For the typical end user, the risks entailed by derivatives are not of a fundamentally different character or magnitude than the risk entailed by cash market investments. Consequently, management knowledge, procedures, controls, policies and standards for derivatives should be similar to, and no more onerous than, those put in place for cash market investments. However, the risk of some derivatives may be difficult to manage and measure because of leveraged and/or artificial terms and conditions and complex contracts. Special expertise, procedures, controls and reporting may be essential in relation to such derivatives, even for an end user.

Credit Risk

Market makers are driven by their desire to maximize transaction volumes to tolerate the highest level of exposure to each counterparty and to transact with the widest credit quality range of counterparties. Credit is an all consuming concern, since without emphasis on credit, traders will expose the company to excessive amounts of credit risk.

The end user on the other hand, has no incentive to expose itself to excessive levels with any one counterparty and no incentive to use any counterparty that is not of the highest quality. The derivatives credit decisions of an end user are straightforward. They need only deal with the highest credit quality subset of those counterparties with whose credit they are already fully familiar as a result of their other investment activities.

Market Risk

The derivative positions of an end user are generally offset by specific assets and liabilities or portfolios of assets and liabilities. The market risk of an end user is, therefore, rather modest, especially when compared to the market risks of these portfolios. Any loss experienced on the derivative position is entirely or largely offset by a gain on these offsetting assets and liabilities. Moreover, the typical end user will utilize only simple, easily understood, easily priced, whose market risks are appropriate for the portfolio and comparable to cash market investments.

For end users, the frequent valuation of derivatives on a stand alone basis is not a primary need, given their objective to use derivatives to complement the assets which fund corresponding obligations. Modelling, measuring and stress testing aggregate derivative exposures across the enterprise is relatively unimportant to the end user. What is important to the end user is the extent to which each derivative transaction successfully resolves the problem it is designed to meet.

Consider, for example, an end user who employs currency swaps to hedge specific foreign currency liabilities, which are funded with domestic currency bonds, or one who uses interest rate swaps to create fixed rate bonds or debt from floating rate bonds or debt. With the possible exception of assessing potential credit risk, the ability and need to use sophisticated analytical tools, which accurately measure risk, may have little relevance to such a user. Such "information" and analysis will shed little light on the end user's financial income and surplus position at risk or whether the derivatives are fulfilling the function for which they were purchased.

In the case of an end user, the analysis of the impact of possible adverse market changes on earnings and capital provided by sophisticated analytical tools which focus on derivatives in isolation from associated obligations may divert investor and financial statement reader attention from more important information needs. For example, sums "lost" on a currency swap may well be offset by gains on an underlying bond investment. For a typical end user, the sums gained or lost on interest rate swaps are matched by offsetting gains or losses on assets or liabilities.

Consider an end user who purchases a Canada bond futures contract which, in conjunction with an equivalent cash position, is duration-matched to a corresponding liability. The capital at risk by way of a bond futures contract, considered in isolation from its liability management context, might not "be consistent with the board's view of the maximum amount of the institution's capital that should be placed at risk." Yet the actual capital at risk, when considered in its asset and liability context, is minimal and is essentially not different than the capital placed at risk through the direct purchase of an asset, such as an underlying government bond. Also, bond futures can be used to reduce required capital at risk by reducing the duration mismatch between an asset and an associated liability. This results in an aggregate reduction in capital at risk, rather than an increase.

On the other hand, the market maker that experiences a loss on its derivative portfolio has no offsetting gain. The loss passes directly to the bottom line. The entire rationale and potential profit or loss from the market maker's derivative transactions depends upon accurate measurement and pricing of derivative market risk.

For the market maker, it is critical that risk exposures be measured across the entire enterprise on the basis of a consistent measurement system and on a real time basis, or at least frequently throughout the day. It is also critical to do stress testing to examine how much capital is at risk should adverse market conditions develop.

Compensation Policies and the Separation of Functions

Profits from client transactions, trading and position-taking may be a significant portion of total dealer profit. Where there is the perception or assertion that risk controls and policies will destroy or reduce this profit source, considerable reluctance and entrenched resistance will arise. The board and senior management of dealers may face very difficult choices, which are made easier only if the cost and amount of capital allocated to the risk, and netted against the profit, are appropriate. For the typical end user, derivatives are not a material source of profit. The board and senior management have every incentive to insist on adequate controls and policies to manage derivative risks.

The risk of employee fraud and rogue trading with derivative transactions may be much greater with market makers than with end users. Market makers provide substantial incentives to their traders to originate the maximum possible volume of transactions and the maximum possible profit from position-taking. Typically, 10-12% of a trader's net profits are paid as a bonus. This creates a huge incentive to take big bets for the trader who has an unlimited upside and very little downside. It is the firm that suffers the permanent damage when the inevitable losses emerge. Increasing the volume of transactions is irrelevant to the end user and taking positions with derivatives and the level of incentive compensation is either irrelevant or of much less significance.

It is critical to control procedures that the dealer separates the counterparty credit analysis, credit limit setting and portfolio valuation and monitoring functions for derivatives from the trading and transacting functions. This separation may be desirable for an end user, but only where it is economically justified or feasible. This difference in control practices arises because of differences in the compensation policies and because end users typically use derivatives for purposes other than generating trading and transaction profits. Where end users provide comparable incentives for these activities, the same concerns apply as with dealers and should be controlled accordingly.

1.6 Prudent Best Practices For End Users of Derivatives

Prudent best practices will vary from company to company depending on the range and complexity of derivative products and strategies employed and the frequency, magnitude and objectives of their usage. The risk exposures of an end user with only a handful of plain vanilla interest rate swaps used to hedge are quite different from those of an end user heavily into the full range of derivatives.

Regulatory guidelines on best practices and the G-30 Study discussed in Section 3.1 are all useful sources for prudent practices for derivatives. They do tend to focus on best practices for market makers. While explicitly recognizing that best practices for end users will differ from those of market makers, the failure to more specifically address best practices for end users leaves one with the implication that these will be simply some watered down version of best practices for market makers. This is not the case as discussed in Section 1.5.

Implicit in the suggested approach to prudence in Section 1.4 is the assertion that the risks to which derivatives expose an end user are not inherently different from those to which all investments expose a firm. Consequently, derivatives should be an integral part of the investment policy statement and the company's efforts to manage investments prudently. Prudent management of derivatives begins by reviewing the policies, procedures, standards, controls, reporting and information requirements, etc., that are in place for investments in general. Putting in place similar practices for derivatives, keeping in mind that materiality and complexity of their use, should ensure that derivatives best practices are in place.

Best practices will encompass a full understanding of the risk exposures involved with derivatives and the specific steps needed to monitor and manage them. The discussion of these risks in Chapter 2 are an integral part of derivatives best practices, but will not be repeated here.

1.6.1 Board and Senior Management Oversight

The scope of a company's involvement with derivatives and the necessary policies to insure their prudent use within this scope must be determined at the most senior management level. This follows from the simple fact that derivatives can provide significant benefits or cause material harm to the company. Derivatives can materially impact the performance and solvency of a company. The derivative environment is one of constant innovation and experimentation.

The use of derivatives should, therefore, be an integral part of the investment policy statement (IPS) and risk management policies approved by the board of directors. Derivatives should be subjected to appropriate investment and operating guidelines, and audit, control, monitoring and reporting policies. This scope strategy and policy should be reviewed regularly.

Senior management should develop a well-articulated strategic derivatives policy that is fully consistent with the board's authorizations and that fully reflects the nature of the company's business and investment activities, capital strength, expertise and general risk tolerance. Permitted strategies and types of derivatives should be clearly specified. Maximum market and credit risk threshold control exposures in total and to single counterparties should be specified in terms of market values, notional principal amount and potential exposure. The latter might be defined taking into account current market exposure and the potential for exposure over a specific time horizon at a certain probability level.

Guidelines and limits might be imposed on each type of derivative taking into account the circumstances of their use. Constraints might be imposed on who can be used as a counterparty and limits placed on exposure to any one counterparty. The permitted uses of derivatives could be documented.

Monitoring, documentation, disclosure accounting, regulatory, tax and legal review requirements should be established. Derivative transactions should not be implemented before the legal, tax, and accounting implications have been researched and understood and necessary policies, processes and systems put in place. Senior management review and approval of all new types of derivatives and all new uses of derivatives could be required by the board.

There should be a system in place to monitor and enforce the derivatives policy and to prevent their unauthorized uses and to quickly detect unauthorized transactions.

There may be a need, especially where significant incentive compensation is at stake, to articulate in advance and enforce after the fact, penalties and remedies for violations of derivative policy. The oversight review would receive the highest attention by top management of the derivatives policy.

Those empowered to use derivative instruments, and those responsible for managing and measuring their risks, should be clearly designated by senior management. There may be some difficulty in determining the true value and risk of derivative positions, especially if their financial impact needs to be assessed on a combined basis with a portfolio of assets and block of liabilities. Consequently, only professionals with the requisite knowledge, skills, training and experience to transact and manage the risks involved with derivatives should be authorized to recommend, approve and implement derivative transactions. Compensation will need to be consistent with the requisite knowledge and expertise. Those responsible for derivatives activity need to be conversant with, and fully able to understand and implement, company derivative policies.

It is also critical to ensure that the requisite skills, experience and training required for dealing with derivatives are possessed by those who process, report, control and audit derivatives activities. The G30 survey indicated that only 46% of respondents perceived derivative support function training to be adequate.

The extent to which the risk management functions, management information systems, control procedures and review processes need to be independent from the derivative transaction function should be carefully considered and clarified. Those who recommend, approve and execute derivative transactions should be independent from those who settle and do accounting entries. Accounting entries should provide a sufficient record and audit trail. Settlement and accounting procedures and accountabilities should be documented. While independence is critical to market makers, this issue may be rather easy to deal with for many end users.

Significant system expenditures may be required to satisfactorily track the essential accounting and management information. “Making do” with systems that are imperfect may be the budgetary reality. Careful management assessment must be made to balance the extent of prudent derivative involvement against the costs of adequate systems. Management information systems must be sophisticated enough to measure, manage and report on derivative risk exposures in a timely and accurate fashion. The G30 survey indicated that 70% of respondents used fragmented systems that often required high levels of manual intervention.

There should be a commitment to include in financial statements, reports to senior management and the board of directors sufficient information about the use of derivatives to provide an understanding of the purpose of their use, the extent of their use, the level of risk involved and the accounting treatment applicable. Derivatives used to manage risk should be accounted for in such a way as to achieve consistency of income recognition between derivatives and the managed risks. Derivatives not used to manage risk should receive mark-to-market treatment.

In summary, use of derivatives should be consistent with the overall risk management and capital policies approved by the board of directors. Steps should be taken to ensure that the use of derivative instruments are, in fact, prudent, fit within a prudent framework established by board policy and are clearly documented as such. Only those with the required training should be authorized to transact and only in a disciplined, well-documented and fully monitored and disclosed process. In addition to regulatory issues, the determination of the appropriate accounting, administration and tax treatment should be carefully understood.

1.6.2 Ensuring Derivatives Are Used Wisely

A necessary condition for the prudent use of a derivative is that those with the authority to approve and recommend a transaction should have a thorough understanding of the risks and benefits of the derivative. An end user should be able to identify the currency, interest rate, market, energy and commodity risks to which the company is exposed and should be able to develop policies and strategies to manage these risks using derivatives.

The end user should be able to establish the value of a derivative independently from the counterparty it is purchasing the derivative from. The end user should understand what factors impact this value and how they are likely to, or might, change through time.

Records outlining the rationale underlying the decision to enter into the financial contract and the analysis of alternative strategies should be maintained by the end user. Such records should indicate that the decision was based on accurate, appropriate and sufficient information.

Derivative transactions should be compared with their best cash market alternative and complex derivatives should be compared with simpler. Unless the risk profiles are clearly understood and the cost/benefit analysis supportive, cash market transactions should be preferred and simple should be preferred to complex. It should be possible to demonstrate that the magnitude, complexity and risks arising from derivatives are justified by the benefits arising from their use.

Compare the price and flexibility of the cash market solution to the derivative solution. The pricing of the component parts of a structured investment should be understood in order to evaluate the cost of their convenience. Why give away part of your hard earned spread to a dealer, unless a clear case can be built for the derivative?

The cost/benefit comparison with the best cash market solution will provide confidence and insight into why the derivative solution is the best alternative. Often the cash market solution will be cheaper, more flexible, more liquid and easier to understand and modify through time. The clear delineation of the

purpose, the best cash market solution and the factors that make a derivative solution preferable to the cash market solution will go a long way to ensuring that the transaction is prudent and is documented as such.

If the derivative or derivative strategy is so innovative that it is only available from a single dealer, the user has a special responsibility to ensure that the derivative is thoroughly understood and properly authorized by the company's investment policies and senior management.

Another good check on the prudent use of derivatives is to obtain multiple bids and advice from more than one counterparty, especially when dealing with a new type of derivative to the market place or to the insurer. This will help ensure, not only that the price is fair, but that the planned use of the derivative is appropriate and should achieve the desired objective.

Every effort should be made to benchmark the results of derivative use in the light of their rationale. After the positions are unwound or expire or at the end of each accounting period, the actual results can be compared with what would have been the results if the derivative transaction had not been entered into or, if an even larger derivative exposure had been taken on. In the case of hedging, for example, partial hedging could be compared to no hedging or complete hedging. Benchmarking will help promote understanding and accountability.

CHAPTER 2 – DERIVATIVE RISK

2.1 Some Publicly Disclosed Losses from Derivatives

> *"Derivatives need to be well controlled and understood, but we believe we do that here."* Peter Baring, chairman of Baring Brothers, October 1993, quoted from *The Economist* March 4-10, 1995, p. 19.

Major losses have been experienced by several firms on the international front. Allied Lyons, the U.K. conglomerate, lost 147 million pounds by shorting U.S. dollars and selling call options on the U.S. dollar (about 1.5 billion pounds worth) at a time of U.S. dollar appreciation. Showa Shell Sekiyu, the Japanese affiliate of Royal Dutch/Shell, lost $1.5 billion (82% of shareholder equity). Metallgesellschaft lost $1.4 billion in flawed oil future and forward "hedging" activity. Codelco (Chile) experienced a $200 million loss on metal futures activity. Investors Equity Life Insurance Co. of Hawaii lost $80 million in just a few days from "hedging" involving reverse repurchase agreements and Treasury futures. An accounting director at Nippon Steel lost $128 million on forward exchange contracts.

In Canada, there have been few cases of derivative-related accidents. There have been no cases resulting in bankruptcy or even a rating downgrade prior to 1996. Credit unions in Fort Williams, Ontario, bought options to buy and sell Government of Canada bonds between 1992 and 1994. The rising rates in 1994 led to losses of $7 million; the liquidation of the Ukranian Credit Union; the take over of two other credit unions and a law suit against the credit union's manager and some of its directors. Imperial Life is reported to have lost $15 million in 1990; Royal Bank $5 million in 1993; CIBC $25 million in 1993 and $12 million in 1994 and Crédit Suisse $20 million in 1994. A number of counterparties will suffer losses in the wake of the 1994 liquidation of Confederation Life.

In June of 1994, Harris Trust, the Chicago-based banking subsidiary of the Bank of Montréal, announced that it would cover $51.3 million U.S. of investment losses of customers in their security lending operation arising from $2.3 billion of capped, floating rate collateralized mortgage obligations held in about 40 institutional customer accounts. Subsequently, Boatman's National Bank in St. Louis absorbed $20 million of losses from derivatives in security lending customer accounts. In November 1994, Pittsburgh based Mellon Bank Corp. reported a $130 million after tax loss due to investment losses incurred by its Boston Safe Deposit and Trust Co. subsidiary in its security lending activities. It is not clear whether these banks, acting as agents, had a legally enforceable obligation to reimburse customers for losses.

In 1994, Proctor and Gamble had a $157 million pretax loss, Dell Computer a $35 million pre-tax loss, Gibson Greetings Inc. a $20 million pre-tax loss and Mead a $12 million pre-tax loss, all from leveraged interest rate, yield curve and "diff" swaps. Proctor and Gamble and Gibson Greetings Inc. filed lawsuits for $130 and $73 million, respectively against their counterparty. Gibson Greetings settled out of court, when its counterparty acknowledged that taped conversations showed that one of its employees (subsequently fired) had deliberately told Gibson that its derivatives were worth several million dollars more than their actual value. Air Products and Chemicals lost $113 million pre-tax on leveraged interest rate and currency swaps.

A number of U.S. pension plans have suffered derivative losses. The Louisiana State retirement plan lost $25 million in mortgage derivatives. Arco employees savings lost $22 million on money market derivatives. The Weyerhaeuser Co. pension plan lost $22 million invested in Hedged Securities Associates Inc. as a result of stock option trading. A total of $100 million was lost by Hedged Securities. Odessa College is suing one of the firms that sold it derivatives after losing half the value of its $22 million investments due to derivatives.

Many large, allegedly low risk, money market and short-term government funds, such as those of Piper Jaffray, where eleven lawsuits have been laid, have lost hundreds of millions of dollars from derivatives in 1994, producing total six-month returns of –20% to –30%. Piper Jaffray has agreed to pay $70 million to settle a class action suit and to partially compensate investors for derivative losses in the Piper's International Government Income Portfolio mutual fund.

In September 1993, Yamachi Securities Co. paid more than $90 million in compensation to investors for losses from mortgage derivatives. In 1994, PaineWebber put $33 million into its Short-Term U.S. Government Income Fund and spent $235 million buying derivatives from the fund as partial compensation to investors for losses on mortgage derivative securities called kitchen sink bonds. Bank America Corp. paid $17.4 million into the Pacific Horizon Prime Money Market Fund and $50.5 million into its Government Fund because of losses on derivatives. Fleet Financial Group Inc. put $5 million into three money market funds to make up for losses in structured notes. Zweig/ Glaser Advisers and CS First Boston Investment Management have bailed out their money market funds by injecting money or buying derivatives from the funds at above market value.

Even apparently sophisticated hedge fund and leading investment banking firms were caught off guard in the first half of 1994 and suffered substantial losses from mortgage derivatives and other derivative activity. One hedge fund lost $600 million in two days speculating on the yen. Another hedge fund lost $1 billion in 1994. Argonaut Capital Management and Vaircana Ltd. are large hedge fund companies that went bankrupt in 1994.

Askin Capital Management L.P. had $600 million of investor money in three funds invested almost entirely in mortgage derivatives. When brokers demanded more collateral for loans used to leverage the funds, the three funds had to file for Chapter 11 bankruptcy, since the derivatives had lost so much value. It remains to be seen how much investors will recover.

The Kidder, Peabody and Co. accounting system erroneously booked a profit whenever strips were sold forward to the Fed for reconstitution into a Treasury bond. The price of the strips was based on today's price without interest to the reconstitution date, whereas the price of the reconstituted bond included this interest. The price differential was booked as profit. In this way, their chief bond trader booked $350 million of fictitious profits, while incurring an actual loss of about $80 million. The trader was fired and charged with fraud in 1994. Kidder Peabody also fired a trader for allegedly hiding $11 million of losses on an index-amortizing swap with Nations Bank Corp. Another trader was fired for allegedly hiding $6 million of losses in options on French and Spanish government bonds. Several senior managers have subsequently resigned and further investigations are ongoing.

Salomon Inc. reported in the fourth quarter of 1994 that they had to write off $381 million of previously reported profits because their accounting system had erroneously booked non-existent profits. On February 2, 1995, it announced a further $140 million accounting loss due to discrepancies between predicted and actual swap cash flows accumulated since 1988. On February 27, 1995, it announced another $35 million loss relating to cash flows on a 1988 yen swap.

Merrill Lynch & Co. lost an estimated $377 million in mortgage-backed securities in 1987 and J.P. Morgan, an estimated $200 million in 1992 in mortgage derivatives. An options trader at Banker's Trust resigned in early 1988 after internal audits revealed that he had sometimes put $2 billion of capital at risk, about three times his trading limit. After recalculating profits from his trading activity, trading revenue was reduced by $80 million in 1987.

In December 1994, Orange County declared bankruptcy after estimated losses of $1.69 billion. Moodys is concerned that Orange County may default on its debt. Robert Citron, the treasurer, used "reverse repos" to borrow $11 billion in order to leverage the fund's investment exposure three-fold. Investments in structured notes leveraged the funds exposure to interest rates even further.

Stepped inverse floaters, which pay an initial rate followed by progressively higher rates minus three-month LIBOR in subsequent periods, paid successively lower current rates and dramatically lost market value as rates rose in 1994. Other notes, that paid a rate based on the difference between the yield on ten-year Treasuries and six-month LIBOR were impacted in a similar way as the yield curve flattened in 1994. Simultaneously, the "repo rate" that needed to be paid on the leveraged borrowing rose steadily. A multitude of lawsuits and criminal charges have been laid by various parties including a $2 billion lawsuit against Merrill Lynch laid by Orange County. In April 1995, Citron pleaded guilty to providing false performance data to nine public bond underwriters and to skimming more than $80 million of interest income earned by local agencies to illegally benefit the county.

On February 23, trading on the Shanghai futures exchange exceeded Rmb 854 billion (U.S. $100 billion). In the last eight minutes, massive trading in a single contract caused the price to plummet. Next day, the exchange cancelled Rmb 313 billion (U.S. $37 billion) of these last minute transactions and closed the exchange for six days. Shanghai International Securities, China's largest stock broker had to be rescued from a run on the bank due to investor's concerns over its losses.

In February, 1995, Barings, a U.K. merchant banking group, was declared insolvent after Nick Leeson lost $1.36 billion U.S. (£860 million) on derivatives. Leeson (aged 25 in 1992) went to Singapore in March 1992 to fill a back office clerical job at Simex, the Singapore International Monetary Exchange.

An August 1994 internal audit report indicated that reported profits of $30.7 million to July 1994 were not a result of taking undue risk, since Barings Futures was not authorized to hold open positions overnight in any instrument. The report noted weak controls, especially that Leeson could both initiate trades and ensure that they were settled and recorded to his instructions. In November 1994, a newly formed asset and liability committee began receiving daily reports showing matched trading accounts with long Nikkei 225 futures positions in Osaka and short Nikkei 225 futures positions in Simex. Large cash transfers (in excess of £540 million, Baring's entire capital) to meet margin calls on losing futures positions were assumed to be covered by matching margin accounts on winning positions that would become available at contract maturity.

The *Financial Times* indicated that, Leeson had been circumventing the accounting system since as early as January 1994, when he began allocating premiums on written put and call Nikkei 225 straddle positions to a hidden account 88888. While a strategy of writing straddles should have been successful in 1994, due to the narrow trading range of the Nikkei, the account appears to have had hidden £50 million losses by 1994 year-end.

On January 17, 1995, the Kobe earthquake struck. By January 23, the Nikkei 225 had fallen from 19,350 to 17,950 and Leeson began heavy buying of March and June 1995 Nikkei 225 futures contracts for account 88888. By the time Baring's treasurer provided an analysis of account 88888 to the Baring's board on February 24, there were losses of £860 million on about $7 billion U.S. in long stock index futures.

2.1.1 Some Lessons To Be Learned From Derivative Losses

The number and magnitude of losses just detailed make an eloquent and irrefutable case for the active involvement of the board and senior management in the process of documenting derivative investment policies, risk limits, and measurement, monitoring, reporting and control procedures. Derivatives are important both because of the positive benefits and the damage they can cause.

In many cases, greed and hubris at both the individual and firm level fuelled excessive risk taking and blocked effective action to deal with known risk and control problems. Compensation, control and risk policies must take precedence over greed and hubris, if derivative disasters are to be avoided.

Excessive reliance on models, normal market conditions and recent historical trends have occasionally prevented effective action from being taken before it is too late. Occasionally, losses have spiralled out of control because there were inadequate requirements to measure derivative risks and prices and to report them to management in an appropriate way. The problem was not the sophistication of the measurement process, but that not even the results of simple measurements were reviewed by management.

Suitability

Many corporations, institutions, pension and mutual funds that purchased structured notes and leveraged derivatives experienced huge losses in 1994. The fallout from these losses has moved the question of customer suitability from the retail to the wholesale market. Does a dealer have a duty to provide valuations and simulations to the end user? If the dealer provides such valuations and simulations, has the dealer crossed the line from dealer to adviser with all the consequent fiduciary responsibilities? The relation between the dealer and the end user must be clear.

Best practices for end users should make the issue of suitability central. End user derivative policies should make clear what derivative types, strategies and limits are suitable. And end users have a responsibility to analyze, evaluate, understand and monitor derivatives to ensure they are suitable.

The question of suitability has also arisen for collateral accounts for security lending. Instruments that can give rise to material market risk and which may be inappropriate for security lending collateral accounts (at least without specific approval) would include adjustable rate notes with rates that are not simply set off a money market index, capped rate securities, leveraged securities, securities with rates that are a function of the shape of the yield curve, securities such as CMOs with material extension risk and reverse repos. In general, the market risk profile of cash collateral securities should be similar to that of money market securities.

Barings

While it is instructive to analyze each of the derivative losses just detailed, the Barings bankruptcy is especially instructive.

Barings did some things right. They sent an audit team to investigate because they were concerned about how the large profits were been generated by N. Leeson. They created an asset/liability committee to review derivative exposures on a daily basis. They had a policy in place that required no open positions to be held overnight. Of course, had the audit actually got to the bottom of what N. Leeson was doing, or had the daily report reported the actual exposures, or had the policy actually been followed, none of us would have ever heard of N. Leeson.

Auditors, accountants and actuaries pronouncing on derivative controls and financial accounts need to have adequate knowledge to justify the reliance placed in them. N. Leeson is reported to have been writing straddles, which are neither riskless nor in compliance with Barings policy. Yet the audit report indicated the profits were earned without undue risk because no overnight, open positions were taken. A special account reflected £50 million of derivative losses at 1994 year-end. Accountants accepted the explanation that this amount was a receivable. External auditors appear to have been close to approving the accounts just days before bankruptcy.

The audit report recommended separation of the trading, settlement and accounting entry functions, which were all controlled by N. Leeson. To what extent were greed and hubris the reason why no action was taken?

N. Leeson had confused lines of reporting involving his immediate boss, Tokyo and London. There appear to have been no effective volume limits placed on derivative activity. Barings daily reports showed a perfectly hedged position, when it was not. There was no independent verification of these reports and of the alleged margin account gains that were thought to offset the more than £540 million transferred to cover margin account losses.

2.2 Credit Risk

Derivative credit risk is the risk that loss will be incurred in consequence of a failure to make the full payments, when due, in accordance with the terms of the contract.

Derivative credit risk primarily relates to over-the-counter derivatives, since exchange-traded derivatives on mature exchanges have the exchange as a counterparty and can be regarded as a solid AAA from a credit perspective.

2.2.1 Increasing Recognition of Derivative Credit Risk Exposure

Prior to the late 1980's, relatively little attention was paid to derivative credit risk. The derivative cost the same whether the counterparty was BBB or AAA. This may have been, in part, because early derivative activity primarily related to interest rate swaps, where relatively little of the notional principal amount would ever be placed at stake by interest rate movements. The early motivation for interest rate swaps was largely to arbitrage differences in credit pricing and perceptions across different segments of the capital markets. Credit rating arbitrage in the swap market was rampant.

It is now possible to transact with banks in almost every industrialized country as well as many large corporations, insurance companies, institutional investment houses and an ever growing and changing list of brokers.

In earlier years, there were relatively low barriers to entry to becoming a market maker. To be a market maker required relatively few people, software that is available off-the-shelf, and relatively little capital in relation to the potential for leverage. Every firm anxious to achieve a high return on equity through leveraging its capital had a compelling reason to leap into the breach. In these circumstances, prudence required that an end user give very careful consideration to the strength and experience of counterparties. More recently, the barriers to entry have risen and many market makers have ceased or reduced their market making.

A greater sensitivity to credit risk has come with the explosive growth in derivative use, the rush of new players into the market and the expansion into a broader array of derivatives, where a more material portion of the principal is at stake. Credit enhancing features have been added to transactions and credit pricing differentials have developed.

End users have become much more credit-rating sensitive. Dealers with lower investment grade ratings, or financial and management controls and expertise that are suspect, find it very difficult, if not impossible, to transact with higher credit end users. Special purpose vehicles have been developed to provide credit enhancements and reassurance as to a high level of management and financial controls and expertise to those making a market in derivative transactions.

2.2.2 Controlling Derivative Credit Risk

Derivative credit exposure can be reduced in a number of ways. Care should be taken to ensure that these credit enhancing features are legally enforceable in the event of bankruptcy, however. (See Section 2.9).

Credit exposure can be reduced by the use of good quality, liquid collateral. The use of collateral might be triggered by a large price movement in the underlying asset or index or a credit rating downgrade. Credit exposure can also be significantly reduced by careful use of the full range of credit enhancing clauses. An amount equal to the change in the market value (replacement cost) might be required to be paid at regular intervals, possibly daily, or such a payment might be required to be paid, if the change in the market value exceeded some specific amount. The contract could be automatically terminated, with payment of replacement cost, in the event of a counterparty credit downgrade or a default on any debt obligation of the counterparty. Payment and close-out netting can be required. The contract could be guaranteed by a parent or third party with a strong credit rating or a letter of credit could be provided.

Credit exposure can be reduced by dealing with a diversified set of highly rated counterparties, say, banks rated AA or better. Counterparties should also be required to demonstrate a high level of financial and operational controls and expertise. Concentration with any one counterparty should be carefully monitored and steps taken to diversify away from any concentration. Concentration should be measured in terms of both current and potential future credit exposure.

Exposure to any one counterparty can be reduced by diversifying the derivatives using that counterparty. The fact that counterparty exposure (where legally enforceable netting arrangements apply) can actually be reduced by doing more transactions with that counterparty is a peculiarity which differentiates derivative credit risk management from cash market. The simplest example would be to choose a counterparty, where the greatest exposure is to decreases in rates, to do a swap to receive fixed payments. This will reduce potential exposure to this counterparty arising from a drop in rates.

For market makers, it is essential that the assessment of credit risk from the use of derivatives be handled by a function independent from the trading function. The transaction volume driven function and incentive compensation of a trader of a market maker is in inevitable conflict with credit issues. The trader will want unlimited exposure to each counterparty and the ability to deal with all counterparties.

Separating the trading and credit function may not be an important consideration for derivative end users. There is no transaction volume incentive for the end user trader to push the fringes of credit. The use of derivatives may be relatively infrequent and restricted to a formally approved list of a few well-known, highly rated, sophisticated counterparties. Peer review of approved counterparties and a diversification of exposure across counterparties may suffice in such situations.

2.2.3 Current Credit Exposure of a Single Derivative Transaction

Current derivative credit risk is related to the market value or cost of replacing the derivative in the market. If the counterparty defaults, the company can be made whole by incurring this replacement cost. Credit risk cannot be measured by notional principal amount. Credit risk fluctuates over time as a function of the net cash flows that must be paid or received on the contract. If the derivative has negative replacement value, there is no current counterparty risk.

Forward-type contracts involve no, or very little, initial counterparty exposure since they could be replaced at origin at no, or little, cost. Option-type contracts involve an initial counterparty exposure to the purchaser equal to the option premium. Structured investments have an initial counterparty exposure similar to that of the cash market instrument in which the option is embedded.

Forward-type contracts entail bilateral credit risk, since either party may be exposed to credit losses depending on movements in the price of the underlying asset or index. Interest rate, commodity and equity swaps do not involve the exchange of principal. They are executory contracts, which need to be performed only if the counterparty performs.

The method of calculating the replacement cost can be illustrated for interest rate and currency swaps. A current "zero-coupon" swap curve analogous to a zero-coupon or spot-bond curve is calculated from current banker acceptance rates (overnight spot, 1, 2, 3, 6 and 12-month terms) and current swap rates (2, 3, 4, 5, 7, 10, 15, 20 and 30 years). The present value of the fixed payments on the existing interest rate swap, less the present value of the fixed payments on a new interest rate swap, with the same remaining term, floating index and rate reset frequency, is calculated using the zero coupon swap curve. This difference is the replacement cost to the counterparty receiving the fixed payments.

In the case of a currency swap, zero-coupon swap curves are developed for both currencies. The present value of the payments in each currency is calculated using its zero-coupon swap curve. The spot exchange rate is applied to convert the present value of the foreign currency payments into Canadian dollars. The converted present value is subtracted from the present value of the Canadian dollar payments. This difference is the replacement cost of the currency swap to the counterparty receiving the Canadian dollar payments.

2.2.4 Potential Credit Risk of a Single Derivative Transaction

Potential credit risk is an important, but difficult, consideration in assessing derivative counterparty exposure. In the case of traditional investments in bonds and stocks, the current market value gives a reasonable indication of the potential credit exposure. Thus, consideration of the potential exposure separately from the current exposure is not usually an important consideration. Assessing the credit risk of any fixed income instrument, such as a zero-coupon bond, in which there can be a material accrual of interest income would require consideration of potential credit risk.

In the case of derivatives, the current replacement cost may not give any indication of the potential credit exposure. A negative replacement value indicates nothing at all about the potential for credit exposure, if the underlying asset or index values shift unexpectedly.

The potential for credit risk exposure varies considerably between the different kinds of derivatives. The potential exposure of a currency swap or structured medium term note is many times the potential of an interest rate swap with the same notional principal amount, for example.

In 1988, the Bank for International Settlement (BIS) issued a Capital Accord that established capital requirements for the credit risk of both balance sheet assets and derivatives. The Accord asserted that the best way to assess credit risk of derivatives is to determine the current replacement cost by marking contracts to market and then adding a factor (the "add-on") to reflect the potential future exposure over the remaining contract life. The add-on amount for a particular transaction is calculated by multiplying the notional principal amount by the appropriate add-on factor. The credit equivalent amount is the sum of the replacement cost and add-on.

Banks are required to hold 8% capital against the credit weighted BIS credit equivalent amount. For selected countries, the credit weights are 0%, for OECD banks 20% and for other credits 50%. The OSFI MCCSR capital formula follows the BIS formula for derivatives.

In July 1994, the BIS issued a proposal to recognize netting, see Section 2.2.5 in the calculation of add-ons and to expand the matrix of add-on factors of the 1988 Accord. In April 1995, a revised amendment was issued to be effective by year-end 1995.

Add-on Factors Effective 1995 Year End

Residual Maturity	Interest Rate	Exchange Rate and Gold	Equity	Precious Metals Except Gold	Other Commodities
One year or less	0.0%	1.0%	6.0%	7.0%	10.0%
Over one year to five years	0.5%	5.0%	8.0%	7.0%	12.0%
Over five years	1.5%	7.5%	10.0%	8.0%	15.0%

Interest rate contracts include single-currency interest rate swaps, basis swaps, forward rate agreements, interest rate futures, interest rate options purchased and similar instruments. Exchange rate contracts include cross-currency interest rate swaps, forward foreign exchange contracts, currency futures, currency options purchased and similar instruments. Equity contracts include forwards, swaps, purchased options and similar contracts based on individual equities or equity indices. The residual maturity can be set equal to the time until the next contract reset date at which the contract mark-to-market value is reduced to zero by settlement of outstanding exposures. The add-on for single currency floating/floating interest rate swaps is zero. The effective notional amount is to be used for leveraged derivatives rather than the nominal amount.

The BIS measures, and similar measures that apply a set of factors that vary by remaining term and derivative type to the notional principal amount, do not reflect the price volatilities of the underlying asset or index and the term of the contracts in a precise fashion. The use of such measures of potential credit risk may be adequate for an end user involved in a relatively small exposure of plain vanilla interest rate and currency swaps to high quality counterparties. The greater the exposure, the more complex the derivatives and the lower the counterparty credit risk, the less satisfactory are such measures. Certainly such measures are inadequate for market makers.

A better measure of the potential credit exposure uses Monte Carlo simulations to determine what would be the largest replacement cost of the derivative at the 99% confidence level, say, over the remaining time to contract maturity based on its current value and a stochastic model of changes in the underlying asset or index values and resulting derivative replacement cost exposure. Option valuation models are also used to assess potential credit risk.

Potential credit exposure increases with the term of the exposure. The counterparty has a longer time to get into trouble and the derivative replacement cost exposure has a longer time to increase in value. For this reason, steps taken to control potential counterparty exposure should increase with the term of the exposure. A company willing to deal with AA counterparties, might only deal with AAA counterparties beyond five years. Only certain sovereign counterparties might be accepted for terms beyond ten years.

An actual loss because of default depends not only on price movements in the underlying asset or index, but also on the financial distress of the counterparty. The potential credit exposure can be combined with counterparty derivative credit quality information to obtain information on expected losses and an appropriate provision for adverse deviation. Credit enhancing features should be reflected in assessing the potential for loss only to the extent that they are legally enforceable.

2.2.5 Close-out Netting and the Measurement of Credit Risk in a Portfolio of Derivatives

The total current and potential credit exposure to a particular counterparty, where more than one derivative transaction is in place, depends on whether payment netting applies to payments on settlement dates and close-out netting applies to replacement costs in the event of default or bankruptcy. Transactions should not be done until master netting agreements have been established.

Payment netting applies if same currency payments from the same office on the same day are netted so that only one payment is made between the counterparties. Legally this is referred to as novation. Close-out netting provides that, in the event of a default or other termination event, all swap agreements are valued and netted and one payment is made between the counterparties to close-out all derivative contracts. With a legally enforceable bilateral close-out netting agreement, one counterparty cannot simultaneously default on negatively valued derivative contracts, while demanding payments on positively valued contracts.

Every possible step should be taken to put in place contractual netting arrangements across the entire derivative exposure to each counterparty and to ensure legal enforceability of these netting provisions. Standardized master netting agreements, such as the International Swaps and Derivatives Association, Inc., 1992 (Multicurrency – Cross Border) ISDA Master Agreement should be used.

If payment netting does not apply, there may be substantial settlement risk. If close-out netting does not apply, then the current credit exposure is the sum of all the positive exposures of individual transactions. If close-out netting applies, then the current credit exposure to any one counterparty is the sum of all positive and negative current exposures. Naturally, positive and negative exposures cannot be netted across counterparties.

Netting of offsetting exposures is allowed in the 1995 amendments to the BIS Capital Accord, if contracts are subject to novation (payment netting) or legally binding close-out netting of replacements costs. No reduction for netting applies, if there is any chance that a liquidator could demand performance on those contracts favourable to the failed counterparty, while defaulting on unfavourable contracts. Netting is not allowed if the non-defaulting counterparty is required to make only limited or no payments to the defaulter, even if the defaulter is a net creditor.

The BIS add-on for netted transactions (A net) is a weighted average of the gross add-on (A gross) and the gross add-on adjusted by the ratio of net current replacement cost to gross replacement cost (NGR). The gross add-on is the sum of the add-on amounts for individual transactions.

$$A_{net} = .4 \cdot A_{gross} + .6 \cdot NGR \cdot A_{gross}$$

where NGR = level of net replacement cost divided by level of gross replacement cost for contracts subject to legally enforceable netting agreements.

NGR can be calculated counterparty by counterparty or on an aggregate basis, if done consistently. Net negative current exposure to a single counterparty must be set to zero in calculating the aggregate net replacement cost.

The aggregate potential exposure to a counterparty is likely to be considerably less than the sum of the potential exposures calculated on a transaction by transaction basis. This is true whether or not close-out netting applies. Some transactions will have a negative value, if and only if, other transactions have a positive value and vice versa, as with same, or similar, term interest rate swaps, in which the company pays fixed on one and receives fixed on the other. Some will have peak potential exposures at different times, as with interest swaps with materially different terms to maturity. Correlations of price changes between derivatives of the same or different type may need to be taken into account. To avoid overstating the potential aggregate exposure, the impact of each scenario should be assessed simultaneously on the entire portfolio, and not on a seriatim basis.

2.2.6 Credit Ratings for Derivative Counterparties

Derivative credit exposures should be managed consistently with the credit exposure from on-balance-sheet assets and liabilities. The derivative credit decision process, procedures, controls, limits, review process and reports should be both consistent and integrated with those for on-balance-sheet exposures.

Rating agency debt ratings cannot be relied upon to assess the credit risks of derivative obligations. The capacity to meet debt obligations can differ markedly from the capacity to meet derivative obligations because of legal issues, the junior status of derivative obligations or the existence of bond covenants and third party guarantees of bond payments.

If the derivative counterparty is an unrated and perhaps unsupported affiliate, a rating cannot be imputed from rated affiliates. Wide differences in credit quality can, and do, exist between affiliates. If some form of guarantee or letter of comfort is provided by a highly rated affiliate, the extent of the guarantee or comfort must be subjected to thorough and rigorous legal review.

The derivatives activity of the counterparty must be part of the credit analysis. A major derivatives-related loss may hit a counterparty, however credit-worthy they might otherwise be, especially if their activity is voluminous, not well understood by their management and they lack appropriate policies, standards, controls and management information systems. Special scrutiny is required, since public financial statement disclosures are not very helpful in assessing derivative risk exposures.

2.2.7 Special Purpose Vehicles

Special purpose derivatives vehicles have been created as subsidiaries in order to deal with credit concerns associated with their parents. The rating agencies establish the minimum capital, systems, experience and other requirements needed for these vehicles to obtain a AAA derivatives program rating. Merrill Lynch Derivative Products, Inc., Goldman Sachs Financial Products U.S. and Salomon Swapco, Inc. have an AAA derivatives program rating.

Before relying on such ratings, the nature and significance of these ratings should be clearly understood, for they are quite distinct both from debt ratings and insurance company claims paying ability ratings. Some market participants do not take such AAA ratings at face value and do not rely on them as a kind of safe harbour.

The rating agencies have been relatively free to establish the requirements needed for an AAA rating. Usually, special purpose vehicles will have restrictions on whom they can deal with, the creditworthiness of their counterparties and whether transactions need to be matched. The ratings have been established using the maximum restrictions on derivative transactions consistent with the requisite flexibility needed by market makers. In this way, the capital required has been minimized.

Typically, restrictions on special purpose vehicles require the closing out of all derivative transactions in the event of default, with all contracts having a positive replacement cost for the special purpose vehicle being closed two weeks before those with a negative replacement cost. In this way, the amounts owing by the vehicle are regarded as secured by the amounts owed to the vehicle. It is then argued that such vehicles only need enough capital to service their contracts over 18 days, the period deemed to be required to liquidate the contracts in an orderly fashion.

Price, volatility and liquidity gapping, together with pricing uncertainty relating to model assumptions and parameter values may cause one to prefer alternative approaches to credit that combine debt credit ratings, collateral and credit enhancements.

2.3 Liquidity and Funding Risk

Liquidity risk refers to the ability to unwind a position in an appropriate period of time without a loss of market value. Funding risk is the risk that a company may not be able to make payments when due.

Because of the high liquidity and ease of implementation, certain derivative (e.g., interest rate swaps) and securitization strategies (e.g., mortgage-backed securities) can be implemented quickly and effectively. The ease of implementation makes them attractive hedging tools. There is no interim period during which a strategy is being implemented, when the unwanted interest rate or market exposure persists.

Complex, highly customized derivatives and structured investments, however, can be highly illiquid. Apparent liquidity can dry up precisely in those circumstances, when it is most needed. The right to unwind a potentially illiquid derivative and the terms, conditions and pricing considerations involved in unwinding should be negotiated at the time the derivative is purchased. Understanding the cost of disposing of derivatives can be as important as understanding the costs of purchasing them.

The liquidity of a particular derivative transaction is closely linked to the volume of transactions in similar derivatives and the bid/ask spread. A transaction is very illiquid if only a single or limited number of dealers are prepared to transact or if a single large transaction can have a material impact on market prices. Wide bid/ask spreads are a reliable indication of illiquidity. Illiquidity and bid/ask spreads can increase substantially following a jump in prices or volatility.

Liquidity risk is of special concern with derivative products, where the derivative value can change more rapidly than the value of a traditional asset. Values may be subject to discontinuities and occasions when uncertainty over values may mean it is impossible to transact, or certainly to transact at presumed theoretical values and at a normal bid/ask spread. Any derivative strategy, which may need to be unwound as a result of adverse market price changes, should be reviewed as to implications of scenarios, where there is no or little liquidity, even if substantial liquidity exists in normal markets.

Apparently sophisticated “hedging” strategies can fail because they presume it will always be possible to measure risks based on market prices and volatilities, that these measurements can be made sufficiently frequently, that no substantial loss can occur without notice, and that immediate action can be taken at fair market prices to rebalance the risks towards neutrality. However, prices, volatilities and bid/ask spreads can, and do gap, and it is not always possible to transact, or at least to transact at what would normally pass for fair market prices or presumed theoretical values.

The cash flows from complex or material derivative and derivative strategies should be projected on a periodic basis in the light of current and possible market conditions, in order to forecast the timing and size of net cash payments that may be required. Collateral agreements requiring the payment or receipt of cash or securities as well as events that may trigger mark-to-market payments or early termination, such as major market moves or rating downgrades, should be incorporated into these projections. Leveraged derivatives and higher risk mortgage derivatives and derivatives related to emerging markets deserve careful analysis in this respect.

A “hedging” or derivative strategy that requires “dynamic hedging” or continuous rolling forward of derivatives may suffer from severe and unexpected liquidity risk. A sudden shift in credit perceptions, either of the company itself, or a major market participant, or a sudden shift in the market assessment or uncertainty with respect to any risk factor, may bring such strategies to a sudden and ignominious halt. A company may lose access to derivative markets or risk management may become much less flexible and much more costly and uncertain. The ability to provide additional credit support or to access alternative strategies should be considered before such strategies are relied upon in a major way.

2.4 Operating and Mismanagement Risk

Operating risk is the potential for incurring material, unexpected losses due to inadequate management supervision and understanding, systems, controls, procedures, accounting, reporting, and errors. Derivatives can be subject to greater operating and mismanagement risk than traditional investments. This is in part due to their complexity, diversity and novelty.

For the end user, the simplest and most critical step in reducing operation risk from derivatives is to subject them to the same control and management policies as for cash market transactions. Risk measurement, management and reporting for derivatives should be fully integrated and on a par with those for cash market investments.

Management control and reporting procedures and systems designed for traditional investments may need to be modified to handle derivatives. Senior management should ensure that adequate resources are available to support the hiring of knowledgable, experienced practitioners and the development and maintenance of procedures and systems to monitor, measure and model derivatives risks.

As with all investments, internal controls should be established and documented for the timely and accurate recording of trades, cross checking confirmation terms and conditions to the terms and conditions agreed to by the trader and entered into the system, and reviewing and ensuring the accuracy, timeliness and appropriateness of management reports. Controls should be in place to ensure compliance with policy and to monitor and report on the extent of such compliance to senior management and the board. Policies should be in place relating to the safeguarding of derivative contracts and addenda.

Market makers will require highly automated, state of the art systems capable of handling large volumes of data in an accurate timely way for an incredible variety of derivative types, terms and conditions. An end user may require much less automation and flexibility, since derivative use may be low volume and limited as to varieties.

There may be no continuity of awareness and understanding of derivatives from the board level, through senior management and down to the transaction level. An island of knowledge at the transaction level is very dangerous for derivatives, as it is for all investment asset classes.

The G30 survey indicated that 29% of respondents felt that their board had “little understanding of derivatives.” Only 18% felt their board had “a good understanding of the concepts and risks.” In the area of derivatives, this suggests that many boards may not have sufficient control of the risks involved.

2.5 Market Risk

Market risk is the risk of losses in on- and off-balance-sheet positions rising from adverse movements in market prices as a result of market wide changes in price volatility, interest rates, exchange rates, equity and commodity values, etc. A market maker will be exposed to market risks in the process of making markets. Also, a market maker or end user will be exposed to market risks when using derivatives to take positions.

Limits should be established for the acceptable range of market risks. These limits should be consistent with the maximum capital that can be put at risk according to the policies of the board and senior management. For an end user, such limits should be consistent with the market exposures that have been established for cash market transactions.

Neither dealers nor end users manage the market risks of particular derivative transactions in isolation. Dealers manage the market risks of their net derivative exposures on a portfolio basis. End users manage the market exposures of derivatives in the portfolio context of their asset and liability balance sheet. A critical step in the process is for the dealer to accurately measure current and potential net exposures and for the end user to accurately measure the current and potential aggregate exposure of the balance sheet.

The management of derivative market risk by dealers should be an independent function from that responsible for approving individual transactions. Such independence may be inappropriate or unjustified for derivative end users.

A market maker should assess market risk on a consolidated basis across the entire enterprise on a real time basis or, at least, frequently throughout the day. Assessment of derivative market risk across the enterprise and on a frequent basis may be of little value to an end user involved in only a limited way, with simple derivatives used in straightforward ways to hedge some or all of the interest rate or currency exposure arising in the course of its normal operations.

Value at Risk

One widely used measure of market risk is value at risk. This is the expected loss from an adverse market movement with a specified probability (confidence interval of 95%, say) over a particular period of time.

While there is general agreement on this approach, there is little agreement as to the appropriate horizon. A time horizon of one day, or the length of time needed to unwind a position, may be the most useful for day-to-day risk management. A fixed horizon of up to one year may be appropriate for capital allocation and other strategic evaluation purposes. There may also be material differences of opinion concerning the appropriate confidence level, the appropriate stochastic model and the parameter values and assumptions underlying the model.

Forward and Option Contracts

Changes in the value of forward-type contracts are of similar magnitude and move in sync with changes in the value of their underlying asset or index. Consequently, the market risk of forward-type contracts arises in large measure from the risk of changes in the value of the underlying asset or index.

The market risks of option-type contracts are measured by delta, gamma, vega, theta and rho as defined in the Glossary. The market risk may be unrelated to the magnitude of the initial outlay, a fact that contributed to many of the losses discussed in Section 2.3. This is especially so with leveraged option-type contracts or swaps, range notes and some mortgage derivatives.

Abnormal Markets and Stress Testing

The market risk of some derivatives is modest in normal markets, but increases exponentially with abnormally large and sudden market shifts. Positions that are apparently hedged for normal markets can give rise to massive unexpected losses, if sudden large market shifts impact components of the position in dramatically divergent ways. “Hedged” mortgage derivative funds have suffered in this way.

Assessment of market risks must take account of how market prices are affected by large adverse market shifts. Stress testing is an important part of risk analysis. Stress tests should be performed on a regular basis on those derivatives and derivative strategies that are subject to large losses and value gapping, when markets undergo abnormally large moves. Unanticipated shifts that are highly improbable according to the stochastic process used to assess market risks may result from sudden shifts in market liquidity, as a result of political, trade, fiscal and economic developments.

2.6 Basis or Correlation Risk

Basis or correlation risk is usually defined in the context of hedging. It exists because derivatives are seldom available on the precise instrument required for a perfect hedge. Consequently, the price volatility of the derivative contract does not exactly offset that of the underlying asset or index position. A future on a specific bond or a stock index might be shorted to “hedge” excess exposure on a bond or stock portfolio, respectively.

In the absence of a perfect hedging instrument, the efficacy of the hedge depends on the extent of correlation between changes in value of the hedging instrument and the hedged instrument or position, during the period the hedge is in place. If this correlation shifts adversely, the hedge will not provide the desired protection that had been anticipated. The risk of loss from such shifts is basis or correlation risk. This risk can be substantial, depending on the volatility of the underlying price, the volatility of the derivative price, the extent of price correlation and the term of the hedge.

Basis or correlation risk can be readily generalized to risk management and speculative uses of derivatives and as such should be regarded as a general risk applicable to derivatives and not merely as a risk applicable to hedging uses only. In the case of risk management and speculation, a desired level of risk exposure is targeted and the derivative position used to achieve it. To the extent that no derivative provides the precise exposure targeted, there will be basis risk.

The riskier type of hedge funds thrive by taking large leveraged bets on correlations in one form or another. Generically, a hedge fund goes long one position and short another position, where changes in value of the two positions have been correlated. For example, a hedge fund might purchase a portfolio of Canadian stocks and sell short an offsetting amount of Toronto 35 index futures. The correlation between the long and short positions theoretically enables the hedge fund to take positions while controlling or "hedging" the risks. The reason why the "hedge" position is established is that the hedge fund manager is making a bet that the correlation will shift in a way that has a positive impact on the fund. The reason why the leveraged hedge fund is risky is that the position taken is leveraged and the correlation might shift in ways that have a leveraged adverse impact on the fund.

The leverage in the leveraged hedged fund can be established by purchasing leveraged derivatives or by using derivatives to obtain exposure to a security without putting up the full cost of the security or by borrowing to purchase a security and using the security as the loan collateral. Adverse market moves require additional "variation margin" on the derivative position or additional collateral against the loan. The existence of leveraged hedge funds indicates in one way just how difficult it can be to draw a sharp line between hedging, risk management and speculation.

Basis risk from a futures position may involve no more than the potential widening or narrowing of fixed income spreads between different fixed income investments, different sectors or different points on the yield curve. In the case of cross currency "hedges" or the hedging of interest (principal) only collateral mortgage obligations (CMO's) with principal (interest) only CMO's, basis risk can be very material.

"Hedging" based on no more than "accidental," historical correlations between the changes in values of the hedging instrument and the hedged position can be a form of speculation. Absence market inefficiencies, there should be no free lunches provided by genuine hedging.

Many corporate end users, pension funds and mutual funds relied on the European exchange rate mechanism to support a kind of "speculation" on currency correlations. Instead of hedging high European Monetary System (EMS) interest rate currency exposures, such as Italian lira, Spanish pesetas or Portuguese escudos with their own currencies, they "hedged" them with low EMS interest rate currencies, such as Deutschemarks or Swiss francs. They bet that the close correlation between these currencies that had persisted for several years in the 1980's would continue. Such action substituted straight currency risk for currency correlation risk. For many, this "hedging" increased risk and resulted in material losses, when the EMS that had preserved this artificial linkage between currencies finally broke down.

2.7 Legal Risk

The contractual language and documentation that most clearly and fully creates a legally enforceable arrangement is not entirely clear, nor are all the legal issues and implications. Contracts may not be documented correctly. To limit these risks, legal counsel should be involved in the development of policies to manage and limit legal risks and in the review of all contracts and addenda signed by the company.

A contract may not be valid because, for example, the counterparty fails to have the authority to transact so that the apparent contract is unenforceable. This risk is greatest in relation to local authorities, eleemosynary institutions, pension and mutual funds, unit trusts and public-sector entities. In some countries, derivative contracts are not enforceable because they are classified as gambling activities. In Canada, there is some uncertainty as to whether certain kinds of derivative transactions offend (in a technical sense) gaming and wagering laws.

In 1991, the English House of Lords ruled in *Hazell* V. *Hammersmith and Fulham London Borough Council*, a British local authority, that Hammersmith and Fulham was not authorized to deal in interest rate swaps and need not make payments on these contracts. This decision voided contracts between 130 government entities and 75 of the world's largest banks. Losses of about $200 million resulted.

In the U.S., Maryland's Charles County sued after losses of $5-7 million on derivatives on the grounds that they lacked authority to buy derivatives. City Colleges of Chicago sued after losses on derivatives of $45-50 million on the ground that Illinois law prohibits publicly supported schools from owning derivatives.

The issue of whether or not municipalities have the legal capacity to enter into derivative transactions and the consequences, if they do not, has not been judicially considered in Canada.

The authority of counterparties might constrain the use of derivatives to particular uses only (e.g., hedging or debt management). There is the possibility that a contract might be declared unenforceable because there was no authority to enter into it for the purpose to which it was put. It is generally thought that transactions will be enforceable in such situations, absent knowledge of a lack of authority and the counterparty acting in good faith relied upon representations as to the party's authority to enter into the contract. However, in the case of City Colleges, a lawsuit was brought even though the treasurer provided a form to the counterparty, bearing the college seal that appeared to indicate that the transactions had board authorization.

Failure to act honestly and in good faith creates a risk that a dealer will lose existing clients and the ability to compete effectively for new clients should its failure to deal fairly with clients become public knowledge. Moreover, legal liability may arise in any situation where it is determined that a certain type of derivative is unsuitable for a client or a client's accounts. To avoid legal losses, a dealer may need to satisfy itself that the client has the ability to understand and evaluate the derivatives it sells.

Bankers Trust set aside $423 million U.S. in 1994 in loan provisions against possible counterparty nonpayment on derivatives. This provision is not to cover credit losses but to cover losses from customers seeking legal redress on derivatives with losses. In December 1994, it was fined $10 million by the SEC and CFTC and had to sign an agreement with the Federal Bank of New York governing the sale of leveraged derivative products. A number of banks have made good on losses in customer collateral accounts for security lending and a number of mutual funds have made good losses in their mutual funds. Merrill Lynch is being sued by Orange County.

The Group Of Thirty, Global Derivatives Study, Enforceability Survey (Canada), (The G30 Enforceability Survey) summarizes enforceability issues in the Canadian derivatives market. It identifies concerns involving capacity and proper authorizations for various kinds of counterparties, including all levels of government, financial institutions and pension funds, the statute of frauds, restrictions on the ability of certain counterparties to pledge collateral and legal uncertainties relating to early termination in the event of bankruptcy and insolvency. These issues are discussed in relation to five of the 13 Canadian legal jurisdictions: federal, Alberta, British Columbia, Ontario and Québec. A review of all arrangements with counterparties should be conducted by lawyers familiar with this document and related material.

While the legal enforceability of insolvency termination provisions and of bilateral close-out netting provisions upon insolvency is generally presumed by market participants, this is not entirely settled. Contractual rights with a single counterparty to terminate swap agreements, and to net amounts owing and owed across transactions in the event of insolvency, may be judged invalid. Bankruptcy codes frequently forbid creditors from terminating contracts with entities filing a bankruptcy petition. The enforceability of multi-branch, cross-border close-out netting arrangements is especially unclear.

In Canada, enforceability of termination provisions upon insolvency will depend on the type of corporation and on whether the corporation is being liquidated or reorganized. Under liquidation, one might be involved with voluntary and involuntary bankruptcy under the Bankruptcy and Insolvency Act (BIA), the Winding-Up Act (WUA) or the appointment of a receiver. Under reorganization, one might be dealing with the filing of a proposal under the BIA or the filing of a plan of arrangement or proposal of such a plan under the Companies' Creditors Arrangement Act (CCAA) or a reorganization by the Canada Deposit Insurance Corporation under the CDIC Act.

Both the BIA and CDIC Act have provisions that exempt "eligible financial contracts," which would include most, if not all, derivative transactions from the normal provisions which prevent termination of contracts upon filing for reorganization. According to the G30 Enforceability Survey, it is not clear that the Automatic Early Termination clause of the ISDA agreement would be protected against a stay order granted by the courts to a debtor filing under CCAA. Through the majority vote of other creditors in its class, the counterparty may lose unpaid amounts owed and may be forced to maintain the derivative contract.

According to the G30 Enforceability Survey, the CDIC Act and BIA proposal provisions expressly recognize the validity of a netting provision and allow for its operation. There is no direct recognition under the liquidation provisions of the BIA and WUA, but the master agreement would be treated as a single agreement and set off of mutual liquidated debts would apply.

In summary, termination and netting provisions should be enforceable, except in relation to CCAA, where enforceability may be an issue.

In June 1990, the U.S. Bankruptcy Code was amended to deal with swaps. Section 560 of the Code makes it possible for "swap participants" in "swap agreements," with entities "not exempted" from the Code, to enforce a contractual right to terminate swaps and to net termination values or payments. In January 1994, France passed a law ensuring that in the case of a default on a swap contract by a signatory, a bank or financial intermediary is only liable for its net exposure. However, Germany and Japan have not clarified the legal status of netting arrangements.

The legal status in the event of bankruptcy of collateral backing a derivative position is difficult to determine. Bankruptcy codes frequently suspend the contractual rights of secured creditors to foreclosure and set off in the event of a bankruptcy filing. The U.S. Bankruptcy Code ensures the right of the swap participant to foreclose on collateral in spite of the automatic stay normally applicable in bankruptcy filing.

Federally regulated Canadian financial institutions are restricted in their ability to provide security for obligations including derivatives. Neither the BIA nor the CDIC Act provide for the realization of collateral outside the statutory stay provisions nor do they expressly protect collateral from the preference provisions of statutes.

Bankruptcy codes may provide for the "claw back" of property transferred within a certain period prior to the bankruptcy filing. The U.S. Code limits the power of the bankruptcy trustee to avoid transfers under swap agreements to swap participants.

A Basle Committee of bank supervisors made a proposal in April of 1993 on conditions for where and how bilateral close-out netting can be recognized in the risk-based capital "Basle Accord" of 1988. The proposal would allow netting of current exposures and partial netting of potential exposures under certain conditions. The Federal Reserve Board has issued a proposal on August 22, 1994, that largely follows the Basle proposals.

2.8 Accounting, Tax and Regulatory Risks

Accounting, tax and regulatory issues may obstruct the effective use of derivatives. There may also be substantial risk of loss from adverse changes in the regulatory, tax or accounting requirements, or an unexpected interpretation or application of existing requirements. The full implications need to be examined prior to transacting. See Section 3.4 for a discussion of hedge accounting for derivatives.

There can be considerable uncertainty pertaining to the tax treatment of gains and losses on derivative transactions put to different uses. Inconsistencies between the tax treatment of gains and losses on derivatives and the gains and losses from the positions being managed by them may be a material difficulty. On the other hand, tax issues may be the very reason for entering into the derivative transaction. Withholding tax on foreign investments illustrate this.

2.9 Valuation Risk

There is always some risk in using a model to derive an unknown price from a set of known prices. However, in the absence of fraud, the risk that models materially misprice standard derivatives is small, especially if the model is carefully calibrated to provide market prices for a wide range of derivatives whose prices are known from the marketplace. The risk of mispricing clearly increases the greater the difference between the instruments used to calibrate the model and the instrument being priced.

The difficulty of understanding and valuing derivatives, especially the more complex and innovative ones, is a significant risk. For this reason alone, cash market alternatives should be preferred to derivatives and simple derivatives preferred to complex, unless justified by a well-understood cost/benefit analysis.

There have been several cases of losses, where derivative values were established on the basis of volatility measures and other parameters provided by people who were in a position to benefit from values being placed on derivatives that were above their actual market values. In other cases, where fraud has not been alleged, reliance on model based valuations in the face of lower market based valuations has led to disaster.

In the case of the Askin Capital Management L.P. bankruptcy, David Askin reported fund values to investors in early March 1994 based on a model that showed the mortgage derivatives had dropped only 1.7% in value, even though values had dropped more than 20% based on the values at which they were trading. The value of the PaineWebber Short-Term U.S. Government Income Fund fared well until May 6, 1994, when it unexpectedly lost 4% of its value. The abrupt change in value is likely attributable to the difficulty of valuing the $300 million of "kitchen sink" bonds held by the fund.

The ability to value derivatives in an objective and independent fashion is, therefore, critical, especially where incentive compensation is at stake. Valuation risk, whether fraudulent, foolhardy or merely erroneous, should be a concern when using derivatives.

The time and effort required to understand the derivative and its potential risk/return tradeoffs across a range of likely and unlikely market scenarios can be substantial. The ability to price the derivatives can be daunting, both intellectually and from a systems perspective. This effort is required to ensure the effective and prudent use of derivatives. Yet it may be so substantial that the use of certain types of derivatives cannot be justified.

A process of valuation that is independent from both external counterparties and those responsible for recommending and approving derivative transactions is critical for dealers and valuable to end users. It is also important that valuations be performed and reported that cover a range of adverse scenarios.

For market makers, a critical valuation decision relates to the percentage of expected profit booked as current profit and the percentage held as a reserve. Many of the transactions are difficult to value and impossible to hedge precisely. As much as 40% of expected profit is commonly held against such transactions. A firm that holds no reserves is booking some level of future profits that is unlikely to emerge.

2.10 Risks Associated With Parameter Values and Model Assumptions

Typically, fairly complex models are required to accurately value derivatives, especially if they are not plain vanilla. Models depend on assumptions relating to stochastic processes governing interest rates, currencies, equity values, etc.

Parameter values derived from historical data for a specific observation period are useful for analyzing relative values of derivatives. The accepted method used for pricing transactions relies on the "implied" value of parameters derived from observable market prices. The parameter value will be highly dependent on this "observation period" or these "market prices."

From an empirical perspective, the parameter values calculated from different historical periods can differ markedly. Parameters may have been selected that "fit" results from only a short historical period. Different stages in various business, economic and political cycles may not fit well. From the theoretical perspective, it may be anticipated that the parameter is likely to change materially through time as a result of changing market forces and conditions.

For these reasons, it is important to continually validate model assumptions and parameter values by comparing model values to values quoted in the marketplace. Assumptions and parameter values should be modified, if model values differ materially from quoted values.

Models are prone to programming error and may involve unproven computer and information systems. Models may be relatively new and unseasoned or they may be subjected to continuous "tinkering." They may not yet have been subjected to vigorous audits, independent reviews, systematic testing to uncover material errors.

Models frequently rest on a range of simplified assumptions, some of which are generally known to be problematic or suspect. For example, the assumption of continuous trading without price or volatility gaps and the ability to trade in any volume at fair market value often prove false.

The presentation of model results often require *ad hoc* decisions about how results should be quantified. For example, the "value at risk" measure requires the choice of both an appropriate horizon for the stochastic process and the selection of a confidence level. The bold presentation of a dollar amount at risk may cover over the essential arbitrariness of these decisions.

Frequently, the “market value” used for derivatives is model dependent, either because there is no quoted market value available or because those responsible for the value deem quoted market values to be wrong and model values to be more representative of the “true” value. The source of profit and loss can, therefore, be the assumptions built into the models and the parameter values established. The source of most unanticipated, model-based losses on derivatives is market gapping, where a gap suddenly emerges between model values and those in the market. Many of these are a result of flaws in the model that mean they not only don’t work in abnormal markets, but they actually don’t work in normal markets. The flaws only became apparent in abnormal markets.

No one model is likely to price all derivative instruments in all circumstances with a uniformly high degree of precision. There is the danger that the model is fundamentally flawed or that it will be pushed to value instruments beyond the point where it has validity. The ability to value derivatives using more than one model is a valuable check.

The pricing models of the major derivative dealers produce prices that differ materially, when pricing more complex, less standard derivatives. And these are models that have been developed and refined over long periods of time by the best “rocket scientist” in the business. Reliance on internally developed models should be tempered by regular reality checks with the marketplace. Proprietary, black boxes available from consultants may or may not produce more reliable prices, but they bring with them concerns that the consultant may have oversold the model and that the failure to fully understand the model may contribute to its misuse.

2.11 Settlement and Systemic Risks

As with any investment transaction, derivatives are subject to the risk that the counterparty will not settle its side of the transaction after you have fully paid for or delivered assets on your side of the transaction. Derivative payment netting agreements greatly reduce settlement risk, where payments are made on a cash basis. The settlement risk of many derivatives is less than a cash market transaction, since the notional principal and the underlying asset or index are never actually exchanged.

On June 26, 1974, German banking authorities closed Bank Herstatt after it had received marks from New York banks, but before it had paid dollars to them. Settlement risk is often referred to as Herstatt risk.

Systemic risk refers to the prospect that the failure of a major financial institution will occasion a market melt down or system failure. The payment system transacts in huge volumes. In just a very few days, the payment systems of major countries transact volumes equal to their country’s GNP. Banks routinely settle amounts far in excess of their capital. The largest source of settlement risk in the payment system is related to settlement of foreign currency trades, referred to as Herstatt risk.

A problem at a major bank could have serious consequences for the entire banking system, if the payment system were derailed. The initial default on a large interbank obligation might cause other banks to panic, cutting credit lines indiscriminately. Runs on the initial defaulting bank and on others caught up in its collapse might put a material portion of the world’s financial system in jeopardy.

Derivatives are heavily concentrated in just a few of the largest banks and securities firms. The GAO study indicated that over 90% of bank-related and over 87% of security-firm related derivative activity was concentrated in only seven banks and five security firms, respectively. Instead of diversifying risk, derivatives may seem to be concentrating it. Derivatives create domestic and international linkages between domestic and international financial institutions, markets and systems making them more integrated and interdependent.

The assumptions and models used by market makers and others to price derivatives have much in common. There may be a systemic flaw in these assumptions and models, and a systemic misidentification and/or misevaluation of risks. Commercial real estate, LDC and energy loans confirm the potential for systemic problems.

For these reasons, as well as their opaqueness and complexity, the lack of direct regulation, the scarcity of information, the size, and the never ending innovation, some regulators believe there is greater settlement and systemic risk with derivatives relative to traditional investments. On the other hand, the actual volume of cash flows exchanged in respect of derivatives, such as swaps, is less than 1% of that arising from foreign exchange trading.

CHAPTER 3 – REGULATION AND ACCOUNTING FOR DERIVATIVES

3.1 International Regulatory Developments

Basle Committee on Banking Supervision

In April 1993, the Basle Committee on Banking Supervision (BCBS) issued four proposals representing the first step towards implementation of capital requirements for banks that take into account market risks (the risk of loss due to declines in market value) especially those relating to derivative trading accounts. The four proposals covered the supervisory treatment of market risks, measurement of bank's exposure to interest rate risk, prudential supervision of netting, market risks and interest rate risk, and supervisory recognition of netting for capital adequacy purposes.

When issued, these proposals were widely criticized as crude and inconsistent with market practices. They failed to reflect the netting of, and correlation between, risks and the way in which option values change. They were perceived as foisting a complex set of clumsy calculations on banks with good risk management systems in place.

On July 27, 1994, the BCBS, and the International Organization of Securities Commissions each issued guidelines on the sound internal risk management of derivatives activities, with the agreement of the Central Bank Governors of the Group of Ten Countries. The documents review the basic principles of derivatives risk management, the necessary and appropriate oversight role of the board of directors, senior management and independent risk management functions, continuous measurement, monitoring and control of risks, limiting risks, timely and accurately reporting, management evaluation and review, internal controls and audits, sound risk management practices for each type of risk: credit, settlement, market, liquidity, operations and legal.

The BCBS issued on April 12, 1995, revised proposals for the amount of capital that banks must have to cover market risk. They are to be effective in January 1997. The amended proposals improved the treatment of options and allowed banks to choose to use their own models or a "building block" approach.

On the "own model" approach, capital requirements are based on value at risk. Value at risk is the maximum amount that can reasonably be expected to be lost over a specified period as calculated by their models. Reasonable means "with 99% confidence" and the time interval is 10 trading days. Capital equal to at least three times this value is required in order to allow for the potential for greater instability than occurred in previous years (the observation period for banks).

Additional capital ("plus factor") may be required if their models are poor predictors or their internal risk management controls are poor. A limited allowance for correlations between instruments is proposed, but not between different classes of instruments. Separate guidelines on derivative management principles have been issued. The initial testing of the "own model" approach involving 15 large banks and a portfolio of 350 positions produced widely varying results. After adjusting assumptions, only half "fell into a sufficiently close range."

One concern with the "own model" approach is that firms will adjust their models to reduce their capital requirements. No model, however good, can protect against unidentified, unrecognized and unknown risks such as those that have repeatedly rocked the bank and securities industries and were most dramatically demonstrated in the Barings bank failure. Managerial misuse, misunderstanding and overreliance on models is a concern. Nor can models make up for poor controls, accounting, information and management practices.

Beginning in January 1996, European Union banks must follow the European Union Capital Adequacy Directive (CAD), which by and large follows the original Basle proposals. European banks may have to calculate capital requirements on both the Basle and the CAD approaches.

The Group of Thirty's Global Derivatives Study

The July 1993 report "Derivatives: Practices and Principles," put together by the Group of Thirty's Global Derivatives Study Group, provides solid background on industry best practices for derivatives on the basis of a comprehensive survey of 80 dealers and 72 end users risk management practices. The Group of Thirty (G30) is a group of industry dealers, bankers, central bankers and academics based in Washington.

The G30 study is an important contribution to regulatory guidelines on derivatives developed by international banking and security organizations and Canadian and U.S. regulators. The study provides 20 recommendations to help dealers and end users manage derivatives activity and four ways supervisors and regulators can help improve the process. It also provides an overview of derivatives. The study states that "there is a need to improve the quality of financial statement disclosure concerning transactions in both derivatives and cash market instruments."

In December 1994, the G-30 released the results of a worldwide derivatives survey (responses from 125 dealers and 149 end users): 99% of dealers and 93% of end users said senior management reviewed and approved procedures and controls for derivatives; 95% of dealers and 86% of end users mark derivatives to market for risk management purposes; 54% of dealers (39% more to do so within a year) and 42% of end users do derivatives stress testing; 43% of dealers (37% more plan to use) "value at risk" to measure and limit market risk. End users measure and limit risk based on maximum loss for a specific scenario (40%) or sensitivity to basis point moves (31%).

U.K. Regulatory Developments

In April 1993, the Bank of England issued a report on derivatives. It reported no major problems of market or credit risk from derivatives with firms surveyed, but indicated that close regulation was required because of their complexity. It commented on the potential for systemic risk that would be occasioned by the failure of a large, unregulated dealer. Regulators should ensure that firms are fully cognisant of derivative risks and of the need to institute best practices.

In the U.K., the Financial Services (Regulated Schemes) Regulations of 1991 (Section K on Efficient Portfolio Management) regulates all unit trust derivative activities. The unit trust regulations state that derivatives can be used for reduction in risk (RIR) and efficient portfolio management (EPM) purposes provided that they are permitted transactions. These terms are defined in the regulations and specifically require that the derivative transactions be economically appropriate, fully covered and specifically aimed at a reduction in risk, a reduction in cost or the generation of additional capital or income with no, or an exceptionally low, level or risk. To be fully covered, there must be sufficient cash or investment to meet any obligation to pay or deliver that could arise.

A switch in market and currency exposure through the use of derivatives rather than through the sale or purchase of cash market investments, and covered option writing are specifically countenanced, subject to specific additional terms, conditions and clarifications.

The Insurance Companies (Accounts and Statements) (Amendment) Regulations (1994) effective July 1, 1994, requires additional information on derivatives including investment guidelines, the impact of acquiring or disposing of assets under derivative contracts and the maximum loss in the event of counterparty failure both currently and in the foreseeable future. It requires the abstract of the valuation report prepared by the appointed actuary to provide a description of the investment guidelines and the method by which allowance has been made for derivatives in the determination of the amount of long-term liabilities. It requires directors, as part of the Department of Trade and Industry (DTI) return, to list "any published guidance with which the company's systems of control or

in accordance with which the return has been prepared." To the end of 1994, the DTI had issued only one Guidance Note 1994\6 relevant to this requirement as it applies to "Systems of Control." More documents are to be anticipated. Compliance with such guidance notes or their published equivalent is not mandatory, nor is there a requirement to state failure to comply. However, failure to list documents complied with is "bound to raise questions in DTI over whether adequate systems of control are in place."

Prudential Guidance Note 1994\6 makes particular reference to derivatives, but does not impose detailed requirements. It allows insurance companies the freedom to establish their own procedures appropriate to their circumstances. However, the DTI is concerned that some insurance companies have only limited experience with derivatives, and that without proper policies and controls, they can expose a company to substantial risks. The DTI, therefore, encourages insurers to understand derivatives and their risks and provides guidance on a broad derivative management framework.

Prudential Guidance Note 1994/6 notes that regulations require the disclosure of derivative investment guidelines and derivative exposures faced during the year. It notes that speculative, leveraged and other uses of derivatives may violate regulatory requirements to implement appropriate investment strategies and the need for close matching of linked assets and liabilities and currency matching and localization of assets. The note makes reference to the responsibilities of the appointed actuary, the need for appropriate credit review procedures, credit and market exposure limits, monitoring procedures, clear definition and communication of policy, sufficient, qualified and competent staff and appropriate compensation packages.

Directors have a fiduciary responsibility, and may be potentially liable, for ensuring that management has implemented an appropriate derivative control framework. Board reporting should be in sufficient detail and frequency to allow the Board to satisfy themselves that adequate controls are in place and risks are properly assessed and regularly reviewed. Annex C, "Controls Over Derivatives," states that directors " should take all steps which are reasonable... to satisfy themselves that management" fully understands the nature of the derivatives used and the exposures they occasion; has documented clearly the objectives, policies and uses; will monitor their use; has set limits on their use; has given due regard to uncovered transactions; has adequate systems to measure risks in a timely fashion; is capable of analyzing and monitoring all derivative risks; has sufficient, independent checks on the process; has sufficient information and control procedures in place; and has adequately tested models and programs.

In January 1995, the Institute of Actuaries and the Faculty of Actuaries issued a guidance note, GN25 on Derivative Instruments. The note deals with risks to be addressed by prudent management controls; assessing the adequacy of controls and provisions to cover the risks, quantifying the financial impact of derivatives and giving advice under the Financial Services Act. The Insurance Companies Act 1982 (as amended in 1994) requires insurance companies to have systems of "sound and prudent management" and charges appointed actuaries with apprising themselves that such systems exist and suitable controls are in place. This applies to derivatives.

3.2 U.S. Regulatory Developments

Insurance Company Regulations

The authority for a U.S. life insurance company to use derivatives varies considerably from state to state. Usually, the specific types of derivatives permitted are listed. Very few states explicitly permit the use of swaps, caps and floors. Restrictions on the amount of derivatives and on administration, recordkeeping and written policies are often specified.

The authority may derive from statute, Insurance Department rules, regulations or bulletins, or informal guidelines. In some states that provide no written authority, basket provisions may provide the opportunity. However, even this may be problematic, if derivatives are deemed to be investments and there is a requirement that all investments must bear interest or provide entitlement to dividends or income. Some states may refuse permission to use derivatives not otherwise authorized, whereas others may permit specific requests.

Some states authorize the use of derivatives only for risk reduction purposes. Others permit it for risk management, liquidity enhancement, cost reduction or asset and liability substitute strategies. A number of states permit insurance companies to sell exchange-traded put and call options, provided that they are "covered." Speculation is not an authorized use, and is likely to be prohibited by most states.

The August 12, 1994 NAIC exposure draft, "Investments of Insurers Model Act," specifies in Section 19 that derivatives are only allowed for hedging, (risk reduction only) and covered call writing, but not covered puts, caps or floors. The insurer will need to be able to demonstrate the intended hedging characteristics and its ongoing effectiveness through cash flow testing or other appropriate analysis. Permitting the use of derivatives as a cash market alternative is under consideration, but is not currently allowed in the draft. Most derivatives including options, caps, floors, collars, swaps, forwards, futures and similar arrangements are permitted.

The aggregate statement value is limited by the draft Model Act to 3% of admitted assets for options, caps and floors used for hedging, and to 7.5%, when combined with unattached warrants. The aggregate potential exposure of collars, swaps, forwards and futures used for hedging is limited to 5% of admitted assets. Covered calls on fixed income instruments are subject to a 10% statement value limit. Counterparty exposures cannot be netted.

The August 15, 1994 NAIC exposure draft, "Derivatives Instruments Model Regulation," requires an insurer to establish written guidelines for derivative use covering objectives, credit and other risk constraints, permissible transactions, detailed and precise identification of risks hedged, compliance and internal control procedures. Guidelines are to be board approved and the board must determine that the insurer has adequate expertise and systems. Documentation and trading requirements are provided.

SEC, CFTC, OCC, FDIC, FED, CONGRESS and GAO

In the U.S., the SEC and Commodity Futures Trading Commission (CFTC) "share" jurisdiction over use of derivatives by non-banks, and the Office of the Comptroller of the Currency (OCC) and the Treasury deal with banks.

The CFTC was created as an independent agency by the Commodity Exchange Act of 1974 (CEA). The CFTC regulates services, rights and interests in all futures and options on futures contracts in the U.S. They oversee the commodity futures market and matters relating to price manipulation and fraud. The CEA gives the CFTC regulatory responsibilities relating to credit risk, disclosure, pricing, capital adequacy and recordkeeping.

The Futures Trading Practices Act of 1992 gave the CFTC the power to exempt derivative products from its regulation. In 1993, the CFTC exempted individual swaps and structured investments from its authority. In 1994, the CFTC issued a generic statement designed to consolidate and clarify mandated disclosure, primarily relating to commodity futures and option contracts traded on U.S. exchanges. The statement identifies 12 risks dealing with contract terms, execution, exchanges and off-exchange transactions and markets.

The Federal Bank regulator, the Office of the Comptroller of the Currency (OCC), has jurisdiction over bank holding companies and subsidiaries, including those set up to make derivatives markets. In October 1993, the OCC published the guideline BC-277, "Risk Management of Financial Derivatives," detailing new examination procedures, the oversight responsibilities of senior management and the board, necessary expertise, controls and procedures, market, credit and liquidity risks, operations and system risks, legal risks and capital adequacy. These guidelines also cover a determination by the bank of the "appropriateness" of a derivative transaction for an end user. In May 1994, the OCC provided more detailed guidelines in response to questions arising from BC-277.

The Federal Deposit Insurance Corporation has issued a memorandum updating and consolidating its guidance to examiners dealing with derivatives at insured institutions. It provides an overview of derivatives and a framework for analyzing seven risks associated with derivatives. Derivatives are complex because of the way these risks are combined, the difficulty in determining market values and the speed with which market values can change.

In 1984, the Security Exchange Commission stated that a 100% capital charge applied to swaps. Subsequently, broker/dealers conducted most of their derivatives activities in subsidiaries that are not subject to SEC regulation. In 1990, Congress empowered the SEC to obtain information on derivatives activities of broker/dealer subsidiaries. The SEC subsequently issued rules and is now reviewing the information collected.

In 1993, the SEC issued a concept release focussed on the net capital risk. In testimony before congress, the SEC indicated that it would publish guidelines on disclosure for use in 1994 corporate annual statements and is considering various kinds of derivative regulations for mutual funds.

On April 10, 1995, the SEC issued best practices guidelines suggesting that incentive pay at securities firms be tied to their record of regulatory compliance and the degree to which they have refrained from churning client's accounts merely to generate commissions.

In August 1994, the U.S. Federal Reserve Board approved amendments to its risk-based capital guidelines for derivatives. Similar proposals were issued by the OCC. They revise and expand the conversion factors and allow for netting in the calculation of the potential future exposure to derivatives.

On August 17, 1995, the Federal Reserve Bank of New York issued "Principles and Practices for Wholesale Financial Market Transactions." It is a voluntary code of conduct for dealers and end users. It was originally designed to address regulatory concerns over derivative sales practices. However, the code is voluntary and presumes that the end user has independent advice as to the suitability of the derivative, unless written evidence to the contrary exists.

Congress is threatening more regulation for derivatives. Three committees of the House of Representatives and one committee of the Senate have held hearings on derivatives. Several pieces of legislation to increase derivative regulation were introduced in 1994. Regulatory activity is expected to deal primarily with reporting, disclosure and accounting issues for OTC derivatives.

In June 1994, after a two-year study of over-the-counter derivatives, the General Accounting Office (GAO) issued a 200-page report, "Financial Derivatives – Actions Needed to Protect the Financial System." The GAO examined the extent and nature of derivatives use, the risks they pose, how firms control these risks, the adequacy of disclosure and the implications for regulations of their international context and the differences in regulatory structure in different countries.

The study concluded that derivative use is rapidly expanding, has an important function in the global marketplace and enables end users to better manage risk. The protection of financial systems requires coordinated international efforts.

The study concluded that there are significant gaps in federal regulation of OTC dealers and no comprehensive requirements exist to ensure that dealers follow good risk management practices. New dealers are of special concern. Congress should expand regulatory control, regulators should share information and establish standards of internal control. The SEC should ensure registrants have strong internal controls, bank capital requirements should be clarified and should reflect all risks and not just credit. The primary responsibility of managing derivative activity lies with senior management and the board.

The study concluded that accounting standards, especially in relation to hedging, are incomplete, inconsistent and behind the times in relation to business practices. FASB should speed up its efforts and the SEC should encourage FASB to develop appropriate accounting standards.

3.3 Canadian Regulatory Developments

There are unanswered questions as to whether certain derivative products are securities or off-exchange commodity futures contracts for purposes of provincial securities commodity futures legislation. A study has been released by the Ontario Securities Commission which recommends that the Securities Act be clarified as to which sections apply to over-the-counter derivatives. Over-the-counter derivatives are to be exempt from registration and prospectus provisions in the Securities Act.

With the passage into law of the Insurance Companies Act on June 1, 1992, the “prudent person” approach to regulating insurance company investments applies in Canada. The prudent person approach requires that investment portfolios be managed in accordance with the principles that would be followed by an idealized “prudent person.” Such principles are usually taken to include the preservation of capital (the avoidance of loss) and the provision of income (fair return).

In May of 1995, OSFI issued a guideline “Derivatives Best Practices” which provides details on how OSFI interprets prudent practices in the context of derivatives. “This guideline outlines factors that the Superintendent of Financial Institutions expects the management and board of directors of a federally regulated financial institution to consider when derivative instruments are part of its investment and financing profile.” Substantial noncompliance with the provisions of the guideline will be considered an unsafe and unsound business practice.

The OSFI guideline follows closely the G30 recommendations. It recommends board approved written policies and procedures for derivatives, adequate systems for measuring, monitoring and reporting derivative risk and an effective independent set of internal controls and inspection. Senior management should authorize, limit and review derivative activity. Limited end users are distinguished from dealers and active position-takers. Companies are to have risk and credit management functions independent from traders. It also provides guidance in relation to market, credit, settlement, liquidity, legal, operations and systems risks. Limited end-users are distinguished from dealers and active position-takers. Derivative risk management should be fully integrated with the company’s overall risk management system. The hands-off, self-regulatory approach of the OSFI guideline for derivatives was supported by both the banks CBA and insurance company CLHIA responses.

3.4 Hedge Accounting For Derivatives

Tax accounting issues for derivatives are complex and require specific analysis relating to country, type of derivative and the nature of the specific application. Timing of income recognition and whether income is ordinary or capital in character are the central issues. Tax implications should be carefully analyzed by the requisite experts prior to implementation.

United States

Accounting rules and regulatory requirements for derivatives have tended to be piecemeal, inconsistent and sometimes counterproductive. For example, hedge accounting is usually desirable because gains and losses from the hedged position can be recognized in the same accounting period as gains or losses on the hedged position, thereby eliminating a source of earnings volatility. However, sound economic hedging or portfolio management activities may not qualify for hedge accounting treatment and so may not produce desirable financial statement results.

For example, the existing authoritative U.S. accounting rules are Statements of Financial Accounting Standards (SFAS) 52 (accounting for foreign currency forwards and swaps) and SFAS 80 (accounting for regulated interest rate and commodity futures contracts). SFAS 80 permits deferral of gains and losses on futures contracts hedging anticipated changes in interest rates and commodity prices, if the commitment is considered likely to occur, even if it is not a "firm commitment." A firm commitment is defined in SFAS 80 as "an agreement, usually legally enforceable, under which performance" is probable because of sufficiently large disincentives for nonperformance. SFAS 52 does not permit this deferral in relation to foreign currency forwards or currency swaps, unless the commitment is firm.

In the case of anticipated foreign currency risks that are highly probable but not "firm commitments," companies are often faced with a choice to accept the currency risk by not hedging, or to manage the risk by using costly and inefficient derivatives (such as currency options) for which hedge accounting is accepted, or to risk financial statement income volatility arising from marking hedging derivatives (such as forwards, futures and currency swaps) to market.

In the case of a currency risk arising from an existing asset or liability or an anticipated transaction that is a firm commitment, SFAS 52 permits hedge accounting, if it is demonstrated that the hedged item exposes the company to risk, that the hedging transaction reduces the risk and the company designates the hedging transaction as a hedge. SFAS 52 does not require a company to consider whether the hedged exposure is offset by other company risk exposures. However, SFAS 80 requires an "enterprise" risk-test, which precludes hedge accounting, if there are other "natural" offsets for the risk within the enterprise.

While the enterprise risk test has solid credentials in sound risk management practise, it has impractical implications for complex multinational entities, which are not generally managed at the enterprise level. It is onerous to have to prove that a hedged risk is not offset by another economic position across the enterprise in order to qualify for hedge accounting.

SFAS 52 severely restricts cross-hedging, but SFAS 80 permits it subject to a correlation test between the hedged instruments.

The Financial Accounting Standards Board's (FASB's) Emerging Issues Task Force has produced a number of guidance papers on derivatives that are not authoritative, viz.: 84-36, "Interest-Rate Swap Transactions"; 90-17, "Hedging Foreign Currency Risks with Purchased Options"; 91-1, 1 "Hedging Intercompany Foreign Currency Risks"; and 91-4 "Hedging Foreign Currency Risks with Complex Options and Similar Transactions." FASB Interpretation 39, "Offsetting of Amounts Related to Certain Contracts," discusses the right of offset for derivatives with the same counterparty.

SFAS 105 sets out financial instrument disclosure standards for off-balance-sheet exposure and credit risk and SFAS 107 requires disclosure of fair value for financial instruments. (See the discussion in Section 3.7).

A 1986 paper 86-2, "Accounting for Options" by the American Institute of Certified Public Accountants, provides guidelines for options, but it is not authoritative.

The authoritative U.S. accounting rules are silent on the use of derivatives to create "synthetic debt or assets," for creating fixed-rate debt or bonds by overlaying a swap to pay floating on top of floating rate debt or bonds. However, accounting practices have developed which permit the treatment of the fixed swap payments as though they were debt or bonds. Concerns with this accounting treatment arise readily, if the debt (asset) and swap were not entered into simultaneously.

Perhaps the most worrisome accounting difficulty is that all public accounting guidance material requires that a hedged instrument be linked to a specific current or future identified asset, liability or transaction. Hedging strategies dealing with "macro" or portfolio risks appear to be prohibited from receiving hedge accounting treatment.

Significant other accounting issues relate to hedging treatment for "anticipated transactions" that may not occur, and hedging treatment for instruments with high correlation, where future correlation may not occur.

The Financial Accounting Standards Board began a project in 1992 on hedge accounting, accounting for derivatives and synthetic instruments. A "preliminary views document" was developed in 1994, but has not been released publicly. Instead, FASB released "A Report on Deliberations" providing information on tentative conclusions.

At its May 24, 1994 meeting, FASB discussed the criteria that must be met in order to classify a derivative as being eligible for hedge accounting. FASB tentatively rejected risk reduction criteria in favour of a risk management criteria. This is in keeping with the discussion of Recommendation 24 in the G30 report.

In order to be classified as acquired for risk management, and hence as eligible for hedge accounting, the derivative:

- must be designated as held-for-risk management in accordance with stated corporate policy
- should not be actively traded, but could involve constant position adjustment
- should be a normal financing and operating activity
- should have opposite return characteristics to the positions being managed
- should have measurable results

Subsequent to this, FASB has tentatively agreed to a new mark-to-market hedge accounting approach applicable to futures, forwards, swaps, option contracts and similar financial instruments. The same approach would apply to similar instruments currently on the balance sheet such as interest-only and some structured notes. An exposure draft is expected in the second quarter of 1995.

Derivatives would be classified as "used for" or "not used for" risk management. Derivatives classified as "used for risk management" would be recognized as assets or liabilities on the balance sheet and marked to market. Unrealized changes in market value would be reported in a separate component of equity until realized and so would not impact earnings. Derivatives classified as "used for purposes other than risk management" would be treated in the same way except that unrealized changes in market value would be recognized in earnings. All realized gains or losses would flow through income when realized.

This new approach supersedes much of SFAS 80 and SFAS 52. There is strong feeling that the deferral of realized gains and losses on derivatives can only be justified if the derivative is linked to a specific asset or liability and if it can be objectively demonstrated that the derivative reduces enterprise-wide market risk. The narrow applicability of these criteria and their operational impossibility has led FASB to consider abandoning them. There is to be no requirement of a link between a specific derivative instrument and specific risk-hedged. Nor is there a requirement to establish a reduction in enterprise risk in support of hedge accounting. However, there is to be no deferral of realized gains and losses.

The new approach improves disclosure by bringing derivatives onto the balance sheet and accommodates a wide range of risk management strategies. Compliance costs should be relatively less than with current and alternative proposals, since it is relatively simple.

Difficulties arising from the immediate earnings recognition of gains and losses on hedged positions can often be managed by using derivatives that mature, or can be settled, in the same period as the hedged position matures or settles. However, the proposal effectively prevents use of hedge accounting for anticipated transactions, for assets to be purchased in the future and for liabilities to be taken on in the future.

The proposal requires that the gain or loss on the hedged instrument be recorded when it is realized. For hedging of future transactions, this would be at the time of the future transaction. However, the offsetting loss or gain will be recognized over the term to maturity of the asset or liability to be acquired in the future. It does not permit the inclusion of the gain or loss on the hedging instrument as an adjustment to the carrying value of the hedged asset or liability. It will thus create earnings and equity volatility even when used expressly to reduce volatility arising from future transactions.

The SEC has indicated that FASB's disclosure standards are not adequate to achieve appropriate reporting. It has commenced its own investigation into derivative disclosure. It plans to compile disclosure requirements and accounting guidance that would be imposed on SEC registrants in addition to FASB requirements.

On December 19, 1994, the American Institute of CPAs (AICPA) issued a report "Derivatives – Current Accounting and Auditing Literature." It is a compilation of existing guidance on accounting for, and auditing of, derivatives. It discusses basic contracts, risks and other factors in order to provide a context for discussion of current guidance. Its focus is off-balance sheet derivatives.

Canada

The International Accounting Standards Committee (IASC) and the Accounting Standards Board (AcSB) of the Canadian Institute of Chartered Accountants (CICA) have undertaken a joint project to develop standards on accounting for financial instruments. Reducing international differences in accounting for financial instruments is a key objective. In September 1991, IASC and AcSB each issued exposure drafts.

In April 1994, the CICA released a re-exposure draft on "Financial Instruments." The draft attempts to deal with all accounting aspects (recognition, measurement, presentation and disclosure) of all types of financial assets and liabilities including derivatives. Many significant changes to GAAP are proposed, impacting such things as the distinction between debt and equity and the recognition on the balance sheet of certain off-balance-sheet transactions.

Derivatives are to be accounted for separately using the general principles proposed for all financial instruments. If a derivative does not qualify as a hedge but is intended to be held for the long term or until maturity, it would be accounted for using the cost method. In all other cases, it should be carried at fair value with changes in fair value reflected in income when they occur.

Instruments qualifying as hedges will be measured at cost or fair value, following the basis used for the hedged position. The change in the fair value of the hedging instrument will thus be recognized in income at the same time as the change in fair value of the hedged instrument.

Hedge accounting is applicable to hedging of contractual commitments, highly probable future transactions and to hedging of risks arising from nonfinancial assets.

A financial asset or liability can be designated as a hedge at its inception or at a later date. However, the hedge relationship cannot be recognized retroactively (i.e., applied to a period prior to the designation). To be a hedge, the entity must be subject to a risk of loss from an existing or expected price exposure. There must not already be an offset to the risk exposure within the business unit representing the highest level of management at which risks are assessed.

Hedge accounting can be applied, even if the hedge offsets only part of a risk for only part of the time the exposure exists. If the hedging position exceeds the hedged position, the excess cannot be given hedge accounting treatment.

According to the draft, a monetary asset or liability, which is intended to be held to maturity, does not expose the entity to interest rate risk and so is not eligible to be hedged for interest rate risk.

A synthetic financial instrument combines a primary financial instrument and a derivative to effectively create another financial instrument. Floating rate assets or debt are combined with an interest rate swap to receive fixed to effectively create a fixed rate asset or debt. Synthetic instrument accounting accounts for the components on a combined basis (i.e., as though the asset or debt is fixed). The re-exposure draft does not permit this approach.

Cost basis accounting should be applied to both components. However, this may require the recording of "losses" on the swap should the fair value of the swap on its own drop below its cost basis. This potential income statement volatility contrasts with the treatment provided to direct investments with cash flows identical to the synthetic instrument.

3.5 Disclosure Requirements For Derivatives

United States

The main U.S. accounting derivative disclosure requirements for financial statements are provided in SFAS 105 and 107. Financial instrument is defined in SFAS 107 to mean futures, forward, swap or option contracts, or other financial instruments with similar characteristics. The definition excludes on-balance-sheet receivables and payables such as mortgage-backed securities, interest-only and principal-only obligations, indexed debt instruments, structured notes, convertible bonds and nonfinancial commodities. Fixed and variable rate loan commitments and other variable rate financial instruments are included.

SFAS 105 "Disclosure of Information about Financial Instruments with Off-Balance-Sheet Risk and Financial Instruments with Concentrations of Credit Risk" was issued in March 1990 and effective in 1990. It deals only with financial instruments with an identified off-balance-sheet risk of accounting loss. Note that options and interest rate caps and floors owned do not have off-balance-sheet risk of loss. The notional face or contract amount, replacement cost, terms, cash requirements, collateral held and accounting loss in the event of default must be disclosed. A discussion must be provided of credit and market risks and their accounting policies and the conditions under which collateral would be required.

SFAS 107 "Disclosure about Fair Value of Financial Instruments" was issued in December 1991 and effective for larger entities in 1992. It requires the disclosure of the fair value of financial instruments, but fails to clarify whether netting is applicable and to what extent. However, FASB Interpretation (FIN) No. 39, "Offsetting of Amounts Related to Certain Contracts" requires that the reporting for accounting periods beginning after Dec. 15, 1993, be without netting, except in relation to the same counterparty and only under legally enforceable master netting agreements.

Investors and creditors have not found these disclosure requirements particularly useful in analyzing the impact of derivatives on the companies they follow. They do not cover certain kinds of derivatives and they do not require information that is critical. Actual financial reporting often gives an inadequate picture of the extent of a company's derivatives usage and exposure and insufficient information on the uses to which they are put and how their risks are monitored and measured.

In December 1993, FASB published additional proposals for year-end disclosures on derivatives and initiated a fast track project. On April 14, 1994, FASB released an exposure draft "Disclosure About Derivative Financial Instruments and Fair Value of Financial Instruments." The purpose is to correct deficiencies in SFAS 105 and 107 and to mandate additional disclosures.

In October 1994, FASB approved SFAS 119 based on this April 14 draft. It is effective for financial statements for fiscal years ending after December 15, 1994, except for entities with total assets less than $150 million. SFAS 119 applies to all derivatives of U.S. dealers and end users, regardless of their exposure to accounting loss.

For derivatives held or issued for trading, FAS 119 requires disclosure of average and end-of-period aggregate fair values split between assets and liabilities and disclosures of net trading gains or losses in the reporting period split by class, business activity, risk and other categories relevant to their management. The location on the income statement where gains and losses are reported is to be disclosed.

For derivatives held or issued for purposes other than trading, such as for hedging or asset/liability management, SFAS 119 requires disclosure about their purpose (objectives and strategies), business context, how each class of derivative is reported (recognition and measurement policies) and how gains and losses are reported – if they are used for hedging, information on any anticipated transactions involved, the amounts of hedging gains and losses deferred and the transactions or other events that will trigger recognition of these deferred gains or losses in income.

Fair value summary information will have to be presented in one place in financial statements and without netting, except as allowed by FIN 39. Entities are encouraged, but not required, to disclose quantitative information about derivative risks and assets and liabilities to which they are linked by risk management or other strategies. Such quantitative information might include more detail, the equity impact of specific changes in market prices, gap and duration analysis and the average value-at-risk and end-of-period value at risk.

In December 1994, FASB issued a special report "Illustrations of Financial Instrument Disclosures." It provides examples of disclosures satisfying the requirements of SFAS 105, SFAS 107 and SFAS 119 that are designed to be useful to preparers, auditors and others in understanding and implementing the requirements. Illustrations are provided separately for each of a limited user of derivatives, major corporations, domestic and international financial institutions. The distinction between disclosures of derivatives used for trading and nontrading is emphasized.

For 1993, derivative reporting in insurance company statutory statements involved only reporting concerning options and futures in schedule DB. The notional amount of swaps was reported in the notes to the financial statements. Beginning in 1994, information on floors, caps, collars and swaps must also be included in schedule DB. A separate section covers derivative counterparty exposure.

The Securities and Exchange Commission is also insisting on more disclosure on derivatives. The Association for Investment Management and Research rated improvements in derivative financial reporting as one of their top priorities.

Canada

The Accounting Standards Board of the Canadian Institute of Chartered Accountants has asked Canadian companies to comply in their 1994 financial statements with new disclosure rules for derivatives and financial instruments proposed in their April 14 re-exposure draft "Financial Instruments" in paragraphs .183 to .229. In May 1995, the International Accounting Standards Committee issued "Financial Instruments: Disclosure and Presentation" that contains disclosure proposals that are not substantially different from those proposed by the CICA.

The June 1994 OSFI draft guideline "Derivatives Best Practices" included some annual report disclosure recommendations. Concerns were expressed in relation to these disclosure requirements. Disclosure requirements focusing on derivatives in isolation do not properly reflect risks of derivatives used to manage cash asset and/or liability positions. Conflict and confusion may arise if disclosure rules of regulators and accounting bodies in Canada, the U.S., B.I.S. and elsewhere are not coordinated. Disclosure requirements should not emphasize "notional principal amounts" at the expense of "amounts at risk."

In October 1995, OSFI issued a Guideline on "Derivatives Disclosure" that provides application guidance on Section 3860, Financial Instruments, Disclosure and Presentation, in the Handbook of the CICA. It is applicable to fiscal years commencing on or after November 1, 1995.

1. CICA paragraph (para) .52 (IAS 32 para .47) requires disclosure of the extent and nature of financial instruments and significant terms and conditions that may affect the amount, timing and certainty of cash flows, for each class of financial asset, liability and equity. OSFI stipulates that all off-balance-sheet derivatives are to be shown by remaining term to maturity, at a minimum, split into time bands of one year or less, one to five years, over five years. Notional amounts and other information should be disclosed by class of instrument (interest rate, etc.), by type of instrument (forward, etc.), by over-the-counter and exchange-traded, and by held for and not held for trading purposes. Accounting policies relating to recognition, presentation and measurement should be disclosed.

2. CICA para .57 (IAS 32 para .56) – For each class of financial asset and liability interest rate risk information on repricing/maturity dates and effective rates should be disclosed.

3. CICA para .67 (IAS 32 para .66) – For each class of financial asset, the maximum credit exposure (current replacement cost), ignoring collateral, should be disclosed by class of derivative. Significant credit risk concentration should be disclosed. OSFI also requires disclosure of credit equivalent amount based on OSFI's capital requirements guidelines without netting. The amounts can reflect the impact of netting, if legally enforceable on OSFI's criteria and the firm intends to settle by set-off.

4. CICA para .78 (IAS 32 para .77) – For each class of financial asset and liability, fair value should be disclosed. If not practical, the factors impacting fair value should be disclosed. OSFI stipulates disclosure split by "held for" and "not held for" trading, by class and by those in favourable (receivable) and unfavourable (payable) positions. Fair values for on-balance-sheet assets should be split by those held for and not held for trading. OSFI encourages disclosure of average fair value and how this is determined.

5. CICA para .92 (IAS 32 para .91) – The nature of hedged anticipated transactions, the amount of deferred unrecognized gains or losses and expected time to recognition should be disclosed.

6. While CICA para .43 only encourages, the following OSFI requires, disclosure:
   - an explanation of the nature and extent of derivative usage
   - the business purpose they serve
   - the risks they occasion
   - policies for controlling risk such as those relating to hedging, avoidance of concentration of risk and requirements for collateral

7. OSFI requires banks, trust, loan companies and life insurance companies to disclose the positive replacement cost, credit equivalent amount and risk-weighted equivalent by class of derivative instrument. The credit equivalent amount is the positive replacement cost plus an add-on for potential future credit exposure as discussed in Section 2.2.4. Revenue from trading split by net gains, net losses, net interest income and net interest expense should be disclosed.

CHAPTER 4 – USING DERIVATIVES FOR HEDGING, PORTFOLIO MANAGEMENT AND SPECULATION

4.1 Hedging Activities (Risk is Reduced)

To hedge is to reduce risk by taking a position which offsets an existing or anticipated risk exposure arising from either side of the balance sheet or from the relationship between the two sides.

Reducing Market or Systematic Risk Exposure (Hedging)

Derivatives can be used to hedge against market exposures that are subject to volatile price change. Hedging can substantially reduce market risks by "locking-in" current market prices leaving only specific risks from asset ownership to be born by the investor.

In many cases, a direct cash market transaction can reduce the exposure. However, there can be any number of reasons why there is a desire to preserve the existing portfolio intact. Derivatives are a way of reducing exposures without disturbing the existing portfolio.

The interest rate risk arising from ownership of specific fixed-income instruments or a portfolio of fixed-income instruments can be hedged using an interest rate swap or bond put or shorting a bond future. Options can be used to hedge options embedded in assets and liabilities. Currency exposures can be hedged with futures and options on currencies or currency swaps. Buying a put on a stock index can reduce the risk from ownership of a stock portfolio.

Floating rate liabilities (debt) and fixed rate assets can be hedged against increases in rates by purchasing a cap or doing an interest rate swap to pay fixed and receive floating. Floating rate assets and fixed rate liabilities (debt) can be hedged against a drop in rates by purchasing a floor or doing an interest rate swap to receive fixed and to pay floating.

A series of "floors" could be used to hedge a universal life policy crediting rate or a single premium deferred annuity renewal rate against declines in interest rates. A series of "caps" could be used to hedge the crediting rate on universal life policies and the renewal rates on single premium deferred annuities against rises in interest rates. The floors and caps will support higher rates and hence protect against policyholder withdrawals and losses from minimum rate guarantees or "market pricing."

Forwards, futures or options on bonds and swaps can be bought or sold to hedge asset or liability commitments or an excess of assets or liabilities. A series of puts and calls or caps and floors can be used to hedge window GICs or other assets and liabilities in which interest rate antiselection against the insurer arises with any change in interest rates.

A swap spread lock can be used to hedge against a widening or narrowing in the spread of corporate bonds or mortgage-backed securities held in a portfolio. The duration gap of a financial institution can be managed through use of interest rate swaps, bond options and futures.

Businesses or utilities that use commodities are exposed to increases in commodity prices. Conversely, businesses, farmers, etc., that depend on the sale of commodities are exposed to declines in commodity prices. Options, forwards, caps and swaps can be used to lock-in current commodity prices and so to hedge against adverse price changes.

Reducing Risk Through Diversification

Borrowers can broaden their funding sources and investors their investment exposures by participating in the full spectrum of national and international capital markets. A wider range of investment instruments, issuers, sectors, geographical locations, currencies and economies can be accessed. Liquidity, credit and other risk exposures can be diversified and the range of opportunities exploited

to maximum advantage. Investment opportunities may be too small in local capital markets to achieve returns commensurate with risks. Undesirable concentrations can be reduced. In general, derivatives free up borrowers and investors to optimize opportunities, since derivatives can be "overlayed" in order to achieve the desired asset and liability structures and risk exposures.

Unbundling of Asset Cash Flows and Asset Risks

A direct investment may entail assumption of multiple risk exposures, some of which the investor is not prepared to assume. An investor may be prepared to take the interest rate and credit risk exposure of a foreign currency bond or the equity risk of foreign stock investments, but be unwilling to assume the currency risk. Derivatives can be used to reduce the currency exposure of such investments. In this way, currency risk can be unbundled or separated from foreign currency investments.

A principal guaranteed synthetic note indexed to a stock index could be used to eliminate potential negative returns in return for less than full upside return.

A direct cash market investment entails the assumption of the full cash flow streams associated with an investment. Derivatives permit cash flow re-engineering of these cash flows. By unbundling and repackaging the cash flows, it is possible to create new cash flow packages that better fit the liquidity, credit and investment horizons of a broader range of investors. Careful partitioning or tranching of the cash flows means a better price can be realized, otherwise illiquid assets can be sold, and risks spread to those in the best position to bear them. Collateralized mortgage obligations (CMOs) are one of the best examples of this.

Modifying Specific Asset or Liability Characteristics

Investment opportunities can be expanded by the use of derivative instruments to modify undesirable features of an attractively priced asset. For example, a floating rate bond with a wide (average) spread to BAs might be combined with an interest rate swap with an average (wide) fixed spread to create a synthetic fixed rate bond at an attractive rate. A convertible bond at an attractive rate could be stripped of its equity risk to create a high yield straight debt exposure.

A forward exchange agreement or currency swap might enable the sale of a foreign currency annuity without taking on foreign currency liability exposure.

Managing Asset/Liability Convexity In An Insurance Company

Typically, an insurer has sold "call" options to borrowers to prepay bonds, MBSs, CMOs and mortgages. These sold call options mean asset duration will shorten relatively rapidly with a fall in rates and lengthen relatively rapidly with a rise in rates. At the same time, an insurer has typically sold options to policyholders to make additional deposits at above market rates in a falling interest rate environment or to make withdrawals at below market rates in a rising interest rate environment. These sold liability options mean liability duration will lengthen relatively, with a fall in rates, and shorten relatively, with a rise in rates. In other words, for a typical insurer, the liability value will increase (decline) relatively more (less) rapidly than the asset value when rates fall (rise). There is a fundamental convexity mismatch, which causes the insurer's surplus to decline with any change in interest rates.

Once this convexity mismatch is quantified, it is possible to purchase options to reduce it. A bond call option could be purchased that will increase in value when rates fall, by an amount which, when added to the increase in value of the assets, will equal the increase in value of the liabilities. A series of call options would be required to protect against a range of interest rate declines. A call option could be purchased to protect against a 25 basis point decline, say. A second call option could be purchased, taking into account the change in value of the first call option, to protect against a 50 basis point rate decline, and so on.

A series of bond put options could be purchased to protect against an increase in rates. A put option could be purchased, whose value increases as a result of a 25 basis point increase in rates by an amount whose value, when added to the decrease in asset values from the 25 basis point increase in interest rates, equals the decrease in liability value from this rate increase. A second put option could be purchased, taking into account the change in value of the first put option, to protect against a 50 basis point rate increase, and so on.

In theory, then, a series of bond puts and calls could be purchased to offset the options sold in the insurer's assets and liabilities. In principle, the cost of these puts and calls should be factored into the asset and liability price. Otherwise, the insurer is taking on risk without compensation.

A series of interest rate floors and caps could also be used to hedge this risk. Alternatively, the insurer could chose to hedge the risk dynamically. Both the asset and liability duration should be adjusted to reflect the duration impact of the options sold. Frequent measuring and rebalancing of the durations can, in principle, keep losses rather modest from even large interest rate changes. Dynamic hedging in the cash market is thus an alternative to the use of derivatives sketched above.

4.2 Portfolio and Asset/Liability Management Activities (Risk is Managed)

Risk management goes beyond hedging in that it seeks to manage risk/return tradeoffs within a prudent risk management framework applicable to both cash market and derivative transactions alike.

Increasing Market or Systematic Risk Exposure

An insurer or pension plan might have an undesirable concentration in a highly illiquid type of investment that cannot be sold directly. Derivatives can be used to "swap" the unwanted exposure to this investment for a more desired exposure that might include switching fixed for floating, fixed for equity, or domestic for foreign exposures.

An insurer or pension plan might have an area of relative investment expertise (i.e., a particular niche, a particular asset class, or a particular country). An index swap allows them to take maximum advantage of this expertise, but to exchange it for an exposure that is more desirable from a total return, diversification, asset mix, or risk management perspective.

Foreign investors may be denied direct access to certain markets. Many restrictions and logistic difficulties arise when creating a diversified exposure to world markets. Certain types of investments might require a high degree of skill and expertise or involve high entry costs and volume-based efficiencies that are prohibitive. An equity swap or a synthetic note indexed to a basket of foreign equities can enable an investor to gain the benefits of diversification in a cost-effective way without having to own the physical security. Derivatives can be used to obtain exposures to such markets and investments.

A cash market transaction may involve exposure to several risks, some of which are undesirable. Unbundling of risks, possible through derivatives, can enable the investor to increase precisely the risks desired. This can be achieved by taking on the cash market position and hedging the undesired exposure. Alternatively, a derivative may be available, which provides precisely the desired exposure without any of the undesired exposures. While this use of derivatives to tailor-make risk exposure increases market exposure to a particular risk, it is equivalent to a cash market position combined with a hedge.

To protect against the adverse impact of sharply higher rates on floating rate liabilities or fixed rate assets, an investor can simultaneously buy a cap and sell a floor (i.e., purchase a collar). While selling the floor increases exposure to falling rates, a reduction in net premium paid, an expectation that higher rates are more likely than lower, and an excess of asset duration relative to liability duration, may make such a balancing of risks and rewards prudent.

Derivatives can be used to manage the mix of exposures to which an investor is exposed in response to changing market conditions and investor expectations. Thus, futures, options, caps, floors and interest rate swaps can be used to increase or decrease exposure to interest rate changes at various points along the term structure. Currency forwards and swaps can be used to adjust currency exposures to a range of currencies due to heightened concerns or perceived opportunities.

Covered Put and Call Writing

Derivatives provide opportunities to earn fees for making markets.

Option premiums from writing calls against a portfolio or selling puts against a money market position can be used to boost yield on a portfolio. The risk to the option purchaser is the loss of the premium paid. The risk to the covered call writer is the opportunity cost of owning the underlying asset or index, but not being able to benefit from increases in the value of the underlying asset or index. The risk to the covered put writer is the opportunity cost of not owning the underlying asset or index, but not being able to avoid the losses from declines in value from the underlying asset or index. In the case of a covered call (put), the writer foregoes (bears) the gain (loss) in the underlying asset or index relative to the strike price.

A portfolio manager owns a stock with a current market value of 30. The manager concludes that the stock should be sold, if its price increases to 32 and bought, if its price drops to 28. Moreover, the manager believes the stock is stuck within a trading range between 28 and 32. The manager can implement this strategy very effectively and earn option premiums by selling a call with a strike price of 32 and a put with a strike price of 28. If the stock price stays within the range of 28 to 32, the manager's underlying portfolio remains intact. If the stock price rises above (falls below) the call (put) price of 32 (28) at expiry, the stock will be called (put) at a value of 32 (28). This will implement the strategy for the stock chosen by the manager. In any case, total returns are enhanced by the call and put premiums.

A similar strategy can be applied in relation to prices for a particular Canada bond currently trading at 7%. The bond manager's view is that the bond will trade between 6.80% and 7.20% and that the bond is overvalued at 6.80% and undervalued at 7.20%. A call could be sold at a strike yield of 6.80% and a put sold at a strike yield of 7.20%. The option sales enable the manager to act on these views and to enhance returns. If the sale of puts and calls are done against a stock or bond index, the manager can implement strategies at the portfolio level, while enhancing returns.

Managing Asset Allocation or Strategy

There may be a need to rebalance asset mix on a regular basis to a long-term policy mix in a passive management strategy. There may also be a need to manage asset mix or market exposures in portfolio insurance, tactical asset allocation and market timing strategies. Bond and stock index futures and interest rate and equity swaps can be used to manage asset mix or market exposures in all these cases. Such uses can reduce the transaction and opportunity costs of portfolio management. They enable managers to buy and sell substantial positions without distorting market prices and they permit cost effective and timely implementation of strategies.

Arbitraging Price, Tax, Regulatory, Legal, Accounting and Risk Based Capital

Price arbitrage arises when it is possible to buy and sell the same or similar position in different markets at a profit. Derivatives can be used to take advantage of price differences that may exist in the capital markets due to different participants and differences in credit or other risk perceptions or regulatory, legal, tax or other constraints. The borrower is able to borrow in that market, national or international, that provides the cheapest source of funds. The investor is able to invest in those markets that provide the highest return for any given risk level. Borrowers and investors then use derivatives to achieve the asset and liability structures and risk exposures desired.

Derivatives can be used to overcome impediments to free market access that traditionally produce price arbitrage opportunities. By facilitating arbitrage, derivatives can ensure that all market exposures are priced the same in different markets.

Derivatives can lead to the exchange of the costs, environment, burdens and constraints in one jurisdiction, for those in another supposedly more enlightened jurisdiction. For example, security firms set up off-shore affiliates to trade in over-the-counter derivatives in order to book transactions in nondomestic jurisdictions, where regulation is more favourable to a particular transaction. To the extent that this leads to the prevalence of the lowest common denominator, this may be harmful. To the extent that this brings the market discipline of the international community to bear on unnecessary and costly legal and regulatory burdens and constraints, it will prove beneficial.

Derivative strategies can frequently be developed which create the same or similar market exposures as direct market investments, but in a more effective way. For example, foreign investments by pension plans are limited to a maximum of 20%. Futures on a foreign stock index combined with a Canadian money market position qualifies as a Canadian investment in this calculation. In this way, exposure to foreign stocks can be increased above the 20% limit using derivatives. An equity swap to pay the TSE 300 index total return and to receive a foreign stock index total return might accomplish the same objective. Investments in Canadian stocks designed to closely match the TSE 300 index returns would be made to support the swap. The same or similar types of strategies might also prove effective in relation to withholding taxes or investment constraints imposed on investors in foreign markets.

A bond with an embedded call on a stock index (equity-linked note) can provide the upside exposure to stocks at a much reduced capital requirement level than the 15% MCCSR or 30% NAIC, RBC capital requirement for direct stock investments. The transaction cost and the cost for the protection from the downside exposure to stocks is paid for by the call option premium that is reflected in a lower coupon on the bond and/or through less then 100% participation in the upside. If the bond is issued by a AA dealer, the MCCSR requirement would equal .5% for the AA bond. This capital is required to cover the counterparty risk taken on through the transaction. An equity swap to pay floating and to receive a stock index return might also reduce MCCSR.

Anticipated changes in taxes can be “hedged” in situations where the changes are expected to have differential and offsetting impact on differing counterparties. Tax swaps occurred in 1991-92 in the U.S. because of fears of higher tax rates. In 1994, Morgan Grenfell, a U.K. merchant bank, created a “tax swap” to protect companies from higher corporate tax rates as seems a likely prospect in the event that Labour wins the next U.K. election. An international bank will take the other side of the transaction, since the bank holds equipment leases which result in higher corporate taxes should corporate tax rates be cut.

4.3 Speculation (Risk is Leveraged)

Speculation

Derivative instruments can be bought and sold on a stand-alone basis (i.e., their purchase or sale is not related to, or justified by, other asset holdings or liabilities). At low up-front costs, a speculator can, for example, place a large leveraged bet on a bullish view by buying calls, and on a bearish view by buying puts. In this way, dealers and investors can make large leveraged bets on markets and risks. Most companies and mutual funds have ready access to derivatives that provide leveraging with a factor as high as 50 times. In early 1994, Proctor and Gamble, Gibson Greetings and Mead lost sizeable amounts from leveraged swap transactions.

Speculators can play an important positive role in financial markets by absorbing risk and providing liquidity. The role of the regulator should not be so much to eliminate all speculation but to ensure that speculation takes place in an orderly framework, is supported by adequate capital, is full disclosed to internal management, stockholders and the marketplace and is consistent with the prudent management of financial institutions.

CHAPTER 5 – ASSET AND MORTGAGE-BACKED SECURITIES

The Issuer Perspective

A company may be highly leveraged or may be in a transition stage where it is facing steep borrowing costs. Or a company may wish to diversify its funding sources or to source funds at attractive rates. In these situations, securitization may offer a more efficient and profitable method of disposing of assets and sourcing funds than is available through direct sales in the secondary market.

A company may have a risk problem because of an excess of one type of asset and a deficiency of another type. Or within an asset class, there could be a risk problem due to an undesired concentration in a single issuer, sector, location, etc. The risk problem could be related to liquidity, credit, interest rate or diversification. Or it could be related to the inability to meet capital or other regulatory requirements.

If the assets could be sold to reduce the unwanted risk exposure to the asset class or the unwanted concentration, and the proceeds invested in the preferred type assets, then the risk, capital or regulatory problem could be resolved. Unfortunately, the assets owned may be fundamentally illiquid and low quality so that a direct sale at a fair market price is difficult and unlikely. For example, it is difficult to make direct sales of policy loans, office equipment, leases, credit card and health care receivables, franchise, small business, student, auto, mobile home, personal and other consumer loans, mortgages, real estate and junk bonds whose illiquidity and or credit quality makes a direct sale difficult. Securitization makes it possible to sell such assets.

Securitization generally involves the splitting off from an asset portfolio of a pool of similar assets and the sale of the rights to some or all of the cash flows generated by those assets to investors. The certificates of ownership to those cash flows can be readily sold and resold without impacting the assets themselves, much as in the case of units in a segregated or mutual fund.

An important issue to regulators and accountants with respect to assets sold through securitization is to establish those conditions which justify the removal of the assets from the balance sheet. The CICA exposure draft “Financial Instruments” indicated that balance sheet removal required the transfer of substantially all (at least 95% of fair value of risk and rewards) associated risks and rewards. This contrasts with a criteria that might be based on control of the economic benefits.

In July 1994, OSFI issued final guidelines on “Asset Securitization” and “Transfers of Financial Assets with Recourse.” The former deals with capital adequacy issues and the latter with the accounting treatment applicable to transfers of financial assets, such as receivables, by means of securitization, repurchase and reverse repurchase agreements.

The Investor Perspective

Securitization often enables an investor to gain exposure to an asset class that they cannot gain direct access to, at least to the desired extent or in the desired way. Securitization can range from relatively straightforward *pro rata* sharing of the cash flows from the pooled assets to relatively complex arrangements. In the more complex arrangements, the liquidity, credit, prepayment, extension and other risks can vary extensively amongst the different securities backed by the same asset pool. The risks of some securities will be reduced and the risks of other securities will be leveraged. While an enhanced yield is available for the securities that leverage liquidity and/or credit and/or prepayment and extension risks, the appropriate risk premium can be difficult to establish and the potential for loss in adverse markets has been repeatedly underestimated.

The variation in liquidity premium can be illustrated with mortgage derivatives. Mortgage pass-throughs have bid-ask spreads in a good market as little as 1/32 and PACs 1/4 or more depending on the maturity. The riskiest tranches may only have one bid, from the dealer that created the tranche, and the spread is as wide as 5% in normal markets. In abnormal markets, the spread may widen to 10% and there may be no bid at all.

Life insurance companies and commercial banks have been the main investors in asset-backed securities in the U.S., but mutual funds and investment partnerships have been significant investors as well. It is estimated that about 3% of U.S. life insurance bond holdings are asset-backed securities.

Since 1990, U.S. life insurers have invested extensively in MBSs and CMOs as they reduced exposures to mortgages, real estate and junk bonds – a clear tradeoff of interest rate risk for credit risk. Between 1988 and 1993, life insurance companies increased their holdings of MBSs from 9% to 15% ($81 billion to $269 billion) of investments and from 100% to 140% of capital, according to ACLI. Investments in agency CMOs increased from $18 to $69 billion.

The proportion of U.S. life insurance company bond portfolios invested in loan-backed bonds and CMOs exceeds 30% in many large companies and 50% in some. The proportion of surplus exceeded 300% in many companies, and 500% to over 1000% in some. There are about $800 billion of CMOs with about $400 billion issued in 1993.

5.1 Asset-Backed Securities

Asset securitization, as distinguished from mortgage-backed securitization, has grown quickly in the United States since 1985 and more recently in Europe. Most of the asset-backed securities are backed by credit card and other forms of consumer loans. In 1993, in the U.S., there were nearly 200 new asset-backed issues sold for $60 billion, and the market capitalization of real estate investment trusts (REITS) increased by 133% to $25.6 billion.

In most asset-backed securitizations, a traditional investment or commercial banker acts as agent or manager. A relatively small number of securitizations use boutique or niche firms or others. Just over half are fixed rate and just under half are floating rate.

A typical asset-backed security involves the creation of a trust by a seller/servicer to which a pool of assets is sold with or without recourse. Investors purchase securities issued by the trust and backed by the cash flows generated by the pool of assets held by the trust. A trustee makes the payment of principal and interest to the investors. The seller/servicer receives a servicing fee.

Asset-backed security structures depend on the legal opinion that: 1) the trust issuing the security will not be drawn into the bankruptcy of the seller; 2) the transfer of the loans (receivables) from the seller to the trust is a “true sale”; and 3) the investor has a first perfected security interest in the loans. There is legal risk that these opinions will be challenged and challenged successfully.

There is the risk that the bankruptcy/receivership of the servicer may lead to delay of payments. Rapid repayment of principal may cause underperformance.

The rating agencies assign ratings after looking at the quality of the underwriter, servicer and trustee, the quality and diversity of the collateral, including historical pool performance and pool seasoning, legal structure and credit enhancements. The ratings on asset-backed securities do not relate to the timely payment of principal, except that it be paid by the time the trust matures, which is a legal date that may be well after the expected final maturity.

Often the credit of these asset-backed securities is enhanced by placing more assets in the pool than will be needed to meet the payments on the securities backed by the pool, assuming no defaults occur. While enhancing credit, such overcollateralization means the asset-backed securities will tend to be paid back more quickly. An irrevocable letter of credit from a top-rated bank or bond guarantee insurance company may provide for reimbursement of pool loans written off up to some amount such as 5% to 30% of loan balances. To obtain an AAA rating on the basis of a letter of credit, the guarantor would need to be an AAA bank and the guarantee would need to provide coverage against losses at least several times historical loss levels. An issuer may provide a similar guarantee with the security receiving the same rating as the issuer. This form of credit enhancement, however, creates credit exposure to the guarantor.

A cash reserve might be established from the outset. Alternatively, any excess interest earned on the collateral over that paid on the securities plus servicing fees, plus credit enhancement fees, if any, might be set aside to build a credit risk reserve account. This excess spread would revert back to the seller, if and only if, it was not needed to cover credit losses. In this way, the pool assets can experience a degree of credit losses without impacting the payments promised on the securities, and so be rated as high quality by rating agencies.

In certain situations, the cash flows from the asset pools will be stratified into a senior (Class A) security and a subordinated (Class B) security. All losses are absorbed by the subordinated security until it is completely exhausted. The higher quality security will be impacted by credit losses only if they exceed those that can be borne by the lower quality tranche. If the issuer is subject to the Bankruptcy Code and the issuer retains the lower quality tranche, there is a legal concern that, in the event of the issuer's bankruptcy, a court will rule that the pool assets have not been truly sold.

Initially, all prepayments will usually be directed to the higher quality tranche. While this enhances credit quality for the high quality tranche, it increases the prepayment risk of the tranche. The rating agencies may assign an AAA or AA rating to the high quality tranche and a rating of A or lower to the low quality tranche.

CARS

Asset-backed securities backed by a pool(s) of automobile and light truck loans are called CARS. CARS allow issuers, typically banks, automobile finance companies and arbitrageurs, to increase loan volume without increasing their leverage, while passing on or eliminating credit and financing risk. Investors can participate in the profitable automobile loan market without taking on lending and servicing functions. The market has grown rapidly, since the first offering in May 1985.

Loan pools are typically comprised of three-, four- and five-year loans resulting in three- to five-year maturities. Average lives are one to three years as a result of scheduled amortization and prepayment of principal. Multiple class CARS involve securities with various maturities and rates. Most issues are callable at par on any payment date after the pool balance declines to 5-10% of the original balance.

Typically CARS are rated AA or AAA on the basis of letters of credit or other guarantees from entities rated AA or better. CAR ratings reflect loan quality, the pool selection process, the payment structure and the credit support. If the rating derives from a letter of credit (LOC) then the CAR ratings will be impacted by the rating of the LOC provider. Rating downgrades arising from downgrades in the credit support are the primary risk. Consideration should be given to the credit quality of the supporting entity. Loss of principal due to net losses in excess of the credit support is unlikely.

CARS are composed of a great many loans (at least 10,000 to over 150,000) and so provide better

credit and prepayment risk diversification than straight corporate debt. Pool characteristics vary by issuer type. Bank pools tend to contain seasoned loans and up to 30% used car loans. Finance company pools tend to contain more recently originated loans from a wide geographic area. These characteristics impact credit and prepayment rates.

Pass-through CARS give certificate holders an equity interest in a fixed pool of loans. The loans are sold to a grantor trust that issues the CAR. Investors are entitled to all cash flows from the loans. In a pay-through CAR, the originator sells the loans to a limited purpose finance company that issues the CARS notes. The notes are supported by the cash flows from the loans, but do not entitle the note holders to any residual value. The notes are the issuers liability and are nonrecourse to the originator.

The CAR secondary market is becoming increasingly liquid. Liquidity concerns are mitigated by the short life of CARS. Usually investors intend to hold CARS to maturity, however.

CARS are priced to produce an appropriate yield relative to a Treasury issue with a maturity close to the average life arising from a specified prepayment rate. Yields on CARS have generally been higher than on equivalently rated corporate debt and generally provide higher option-adjusted spreads than mortgage-backed securities with similar average life.

Prepayment rates on automobile loans are relatively insensitive to rate changes and so do not present the same negative convexity risks as do mortgage-backed securities. Prepayment rates on CARS are relatively predictable, stable and insensitive to rate changes. The ABS method measures prepayment rates as a percentage of the original number of pool loans. A 1% ABS means that 1% of the original number of pool loans prepay each month. Prepayment of automobile loans are caused by automobile resales and trade-ins. Many consumers buy new cars every two or three years. This leads to slowly rising prepayment rates with pool seasoning. Prepayments also arise from defaults, theft or damage. Even sharp declines in rates provide little incentive to refinance auto loans. Refinancing involves a used car loan which can carry rates up to 2% higher than new car loans. Also the loan amounts and term are relatively short.

Pool loan characteristics impact prepayment rates. Seasoned, shorter term used car loans prepay faster than new, longer term new car loans. However, the variation in prepayment rates is narrow. The impact of variation in prepayment rates on the average life and yield of CARS is relatively small because scheduled amortization of principal on auto loans is a much larger portion of principal repayment than on mortgages. A pool of newly originated loans is unlikely to experience rates below 1.2% or above 1.6%. Average life and yield vary little within this range. Yield uncertainty can be reduced by purchasing CARS near par.

CARDS

CARDS are asset-backed securities issued by banks and retailers and backed by receivables of credit cards. CARDS were first issued publicly in January 1987. Fixed income investors use CARDS to participate in the huge consumer credit card market.

Credit enhancements mean that senior tranches are rated AAA or AA with subordinated tranches rated A or lower. Credit enhancements for CARDS are designed to provide protection against default rates as much as five to eight times the worst case historical experience.

New issues generally have an average life of two to seven years. CARDS generally have a nonamortization or “lockout” (revolving) period of two to four years followed by a short and relatively predictable amortization period of less than one year or a bullet payment. During the lockout period, principal payments are reinvested in new receivables, thereby maintaining a constant dollar amount of receivables.

CARDS generally have higher yields than comparably rated corporate debt. Prepayment rates are relatively insensitive to rate changes and so cash flows are relatively predictable.

Credit receivables may be general purpose revolving credit cards issued by banks or private label credit card receivables issued by retailers. Such loans have no specific amortization schedule or final maturity date. They are extended and repaid repeatedly over time. The retail category is theoretically of slightly lower quality for several reasons, that are of greater importance, the weaker the retailer.

Card characteristics heavily impact ratings and prepayment risk. The higher delinquency and charge off rates, the higher the interest charges and the minimum monthly payment rates. The percentage of those who pay in full each month is important.

The investor-type certificate typically represents 80% of an issue and is sold publicly. The balance is retained by the seller and is used as a buffer against seasonal fluctuations in outstanding card balances.

The servicer of the credit card receivables (typically the originator) sells specific credit card account balances to a trust or special purpose subsidiary that conveys ownership of the balances to investors through sale of certificates. All new receivables originated from these accounts are sold as created. Accounts are selected so as to be representative of the issuer's eligible pool.

Issuer's counsel must provide a number of legal opinions, for example, that the transfer of receivables is a "true sale," receives accounting treatment as a sale and so on.

In a "hard" bullet structure, a controlled amount of funds is placed monthly into a "principal funding account" earning the certificate rate. If these funds are insufficient to retire all outstanding certificates, a third party guarantor makes up the shortfall up to a specific percentage of the initial offering. However this "maturity guarantee" is costly. A "soft" bullet security has no guarantor, but is structured to make it highly unlikely that the bullet payment is not made. In a controlled amortization structure, principal payments follow an amortization schedule that pays out within a year of when amortization commences and are fairly predictable.

"Early amortization" or "payout" events such as the bankruptcy of the seller, a decline in the yield on the receivables below a certain rate, or a rise in the charge off rate above a certain level trigger a quicker paydown of principal. While this provides credit protection, it does mean CARDS may pay much sooner than expected in a less favourable interest rate environment.

The receivables backing CARDS are unsecured, whereas the receivables backing CARS are secured by new and used autos. Consequently, CARS have far lower delinquency rates and net losses. Credit enhancements make this distinction a non-issue from a credit perspective. The liquidity of CARDS is generally superior to that of CARS because the deals tend to be larger. CARDS allow a wider choice of average lives 1.5 to 10 years versus one to three years for CARS.

The different payout structure of CARS and CARDS have a number of subtle implications. CARS will be more affected by interest rate changes because CARDS have a principle lockout period that makes their cash flows more predictable. The average life of CARDS will decrease more rapidly than that of CARS which benefit CARDS (CARS), when the yield curve is upward sloping (inverted). CARDS have tended to provide a somewhat lower yield than comparable CARS because of their greater liquidity and cash flow certainty. Updated information on existing CARDS may be hard to obtain and CARD holders may have to rely heavily on rating agencies. Banks have a strong incentive to get the receivables off their balance sheets under the new risk-based capital guidelines.

5.2 Mortgage-Backed Securities

In order to securitize mortgages, they are first grouped into homogeneous pools in respect of interest rate and maturity date. In Canada, the mortgages in a pool must mature within six months of each other. Each mortgage bears a fixed interest rate and provides for scheduled payments which are fully amortized over their respective amortization period.

United States

Approximately half ($1.6 trillion) of the $3.4 trillion U.S. residential mortgage market has been packaged into mortgage-backed securities. This is a large highly liquid market, with insurance companies as major participants. Typically, the residential mortgages are level monthly payment fixed rate mortgages with 30-year terms and 30-year amortizations.

So called “balloon” mortgages provide for a 30-year amortization but with a rate renegotiated after five, seven or 15 years, say. A two-step mortgage is like a balloon mortgage in that the rate resets after some period, but the mortgage does not actually mature at the end of that period. The rate is formula based, and may involve a maximum increase over the initial rate.

A growing equity mortgage (GEM) is a mortgage that begins with the same monthly payment as for the standard level pay mortgage. However, monthly payments gradually increase and the mortgage is paid off early. All the above types of mortgages have been used as CMO collateral. Adjustable rate mortgages have not been used as CMO collateral.

Most U.S. MBS issues are so-called agency issues, since MBS payments are guaranteed by a U.S. government agency. The volume is split about evenly between three agencies. Securities issued by the Government National Mortgage Association (GNMA or Ginnie Mae) are backed by the full faith and credit of the U.S. government through the credit support of the Federal Housing and Veterans Administrations. Securities issued by the Federal National Mortgage Association (FNMA or Fannie Mae) and the Federal Home Loan Mortgage Corporation (FHLMC or Freddie Mac) are guaranteed by FNMA and FLHMC, respectively. There is a much smaller, but rapidly growing non-agency market that includes nonresidential mortgages.

Although obligations of FNMA and FHLMC are not backed by the full faith and credit of the U.S. government, it is accepted that the U.S. government would not allow these agencies to fail. Their status as a government-sponsored enterprise (GSE) is based on the facts that they are established by acts of Congress, have five presidential appointees on their board of directors; they are exempt from state and local taxes; they may borrow $2.5 billion from the U.S. Treasury; their debt obligations may be held by federally supervised thrifts, banks and credit unions and by national banks (without limit) and their debt obligations are exempt from SEC provisions. There is a financial regulator within HUD that is responsible for ensuring that FHLMC and FNMA operate soundly and are well-capitalized.

FHLMC was created in 1970 to improve the liquidity of home mortgages and to increase the availability of capital for home purchases. FNMA was created in 1938 to provide liquidity to the mortgage market, especially in the secondary residential market. They provide liquidity to the secondary home mortgage market by purchasing mortgages and issuing participation certificates or mortgage-backed securities. The important economic, political and social functions played by these agencies provide a strong incentive for continued government support.

The residential mortgages securitized by FNMA and FHLMC meet certain underwriting standards and are below a maximum amount ($203,150 in 1994). Such mortgages are “conforming.” Loans that conform except for size are called jumbo loans.

A "fully modified" pass-through guarantees payment of both principal and interest when due. A "modified" pass-through guarantees interest when due, but only guarantees the payment of principal as it is collected but with a maximum delay after it is due. GNMAs, FNMAs and all gold FLHMC Participation Certificates are all fully modified. FHLMC modified pass-throughs provide for payment of principal no later than one year after due.

The first mortgage pass-through (MBS) was done in 1970. In a mortgage pass-through, each security owner receives a *pro rata* share of all pool cash flows after payment of servicing and guarantee fees. Cash flows consist of interest payments, scheduled principal payments, unscheduled principal payments and early prepayment penalties. The first mortgage-backed bond was issued in the mid 1970's.

Canada

The Canadian Parliament established the Canada Mortgage and Housing Corporation (CMHC) in 1946. The CMHC insures first mortgage loans made by private lenders in the housing sector. The CMHC guarantees the timely payment of principal and interest on their due dates as set forth in the loan agreement. Loans guaranteed by the CMHC carry the same credit risk as Agencies of the Government of Canada.

To obtain NHA insurance on a loan, the lender must be approved and the building must conform to construction standards and must be single family dwelling or a rental housing project intended for full occupancy. The lender must confirm that the borrower's equity in the property securing the mortgage arises from the borrower's resources and the borrower's or rental property income must be sufficient to produce an acceptable gross debt to interest service ratio.

Although there is no explicit requirement for the lender to renew the mortgage upon maturity, CMHC practices mean that the lender is, in effect, required to renew performing mortgages or find an alternative lender. The lender must work with CMHC and the borrower to find a resolution in the event of default on payments or taxes, prior to exercising any foreclosure or power of sale proceedings.

In 1984, the National Housing Act (NHA) was amended by parliament to authorize a new activity intended to facilitate the financing of housing, the development of a mature secondary market and the return to longer term lending. The CMHC was authorized to guarantee the timely payment on their due dates of principal and interest on MBS certificates based on securitized pools of NHA insured mortgages.

Under contractual arrangements between the issuer of a pool and CMHC, the issuer is responsible for servicing and administering the mortgages which constitute the pool in accordance with generally accepted practices in the mortgage lending industry. The issuer is liable for ineligible loans where title is defective. The issuer must pay various administrative and processing fees. The issuer must make regular monthly payments to the central paying agent, whether or not the mortgage payments are received from the borrower. The issuer must also pay off the investor at maturity, whether or not the loans have been repaid or recovery made in the event of default.

The amount of each payment to the MBS certificate holder is the scheduled amount plus some adjustments. The primary adjustments are the prepayment penalties and additional unscheduled principal payments or other early or unscheduled recoveries of principal on the pooled mortgage during the preceding month.

There have been some administrative problems with the passing through of penalty interest to the investor, and some investor concern that this aspect has not been adequately monitored. If the issuer waives the prepayment to encourage refinancing, the issuer is required to make the penalty payments to the investor. Some pool issuers retain the prepayment penalty amounts. This can create a conflict of interest, between the issuer, who might mount a campaign to encourage refinancing and the investor, who may stand to lose from refinancing.

The average MBS poolsize in Canada is $12 million. About 3% of residential housing has been securitized in Canada in comparison with about 50% in the U.S. A primary reason for this is that Canadian banks fund 60-70% of residential housing, and, to date, they have only securitized non-profit social housing mortgages. Banks find the risk/return tradeoff of residential mortgages ideal for retention on their balance sheet as a match to GIC deposits.

The volume of MBS issues grew steadily from its beginning in 1987 to a peak of about $6.5 billion in 1993. A sharp drop to less than $4 billion occurred in 1994. After a further expected decline to about $2.5 billion in 1995, new volume is projected by CMHC to increase to about $5 billion in 1997 and to remain at the level until 2000. As of February 1995, the MBS market is estimated to be $17.6 billion of which $8.9 billion are single family prepayable residential mortgage pools and $7.6 billion are non-profit housing pools.

Prior to late 1992, MBS spreads were expressed relative to the pool maturity date even though most of the pool mortgages could mature up to six months prior to this date. Also, no unscheduled prepayments were assumed in the pricing. Spreads were subsequently expressed relative to the weighted maturity of the pool mortgages. Pricing assumed all unscheduled principal payments were made at this date. Spreads are now expressed relative to a same duration Canada bond and a prepayment assumption is made. While this is an improvement, it should be recognized that material differences in the timing of expected cash flows and the potential for cash flow variation across interest rate scenarios of otherwise identical, same duration pools can lead to different spreads.

The pool spread off the Canada bond benchmark would depend on whether penalty interest was passing through, whether the pool is priced at a premium or discount and recent MBS spreads.

MBS pools have a pool numbering system that indicates major differences in the underlying mortgages. Non-profit housing mortgages have no prepayment privileges and a pool prefix of 990. Market multi family mortgages relate to rental apartments and nursing homes and have no prepayment privileges and a pool prefix of 966. However, there is the risk of a substantial prepayment of principal due to a single default. Single family open residential mortgages have prefixes of 964 and 967, if they have penalty interest or they do not, respectively. Mixed pools have a prefix of 965.

5.3 Prepayment (Contraction) and Extension Risks

The underlying securitized residential mortgages can be paid early with no, or very little, penalty. Early payment can arise from the sale of a home due to a move or the purchase of a more expensive home, an insured catastrophe, a death or divorce, payment default resulting in sale, a desire by the borrower to pay off part or all of the mortgage balance or to refinance the mortgage.

As rates drop, the economic incentive to prepay (refinance) increases, and, as they rise, it decreases. The former is prepayment risk, the latter is extension risk. Both risks can produce material financial loss far exceeding that on an initially comparable duration noncallable bond. The early prepayment and extension risk is very difficult to analyze, depending as it does on the dynamic interaction of borrower behaviour and circumstances, investor behaviour, mortgage broker behaviour and interest rates.

Whereas the duration of a noncallable bond increases (decreases) with a decrease (increase) in rates, the duration of the MBS decreases (increases). The former has positive convexity and the latter negative. Buying mortgage-backed securities below par can provide some compensation for more rapid than expected prepayments. The return is enhanced relative to what it would otherwise have been, because the greater than expected principal is prepaid at par even though it was bought at a discount. The impact of having to reinvest the unexpected principal repayments at a lower rate than the yield expected to be earned on the mortgage-backed security at purchase may far outweigh this benefit, however.

The relation through time between current mortgage rates and the average coupon on the mortgage pool affects prepayment rates. The more that current rates fall below the mortgage rate, the more incentive there is to refinance. The longer the term remaining on the fixed rate and the lower the absolute level of the mortgage rate, the greater the dollar impact for a given mortgage balance and interest differential. The larger the mortgage balance, the more dollars at stake and the less impact of fixed refinancing costs such as application fees and legal expenses. GNMA MBS pools typically have a small average mortgage size and so the prepayment rate is likely to be somewhat less than for other pools.

The path that interest rates take to get to the current interest rate environment can influence prepayment rates. Refinancing burnout refers to the fact that there may be relatively few borrowers left to take advantage of a current opportunity to profitably refinance, if this opportunity has existed for some time on prior occasions. A relatively greater rate of refinancing can be expected in response to a current opportunity to refinance profitably, if it is the first opportunity (i.e., if there is no, or little, refinancing burnout).

Quantifying path dependency of prepayment rates is complex. A useful, relatively simple approach uses a ratio called the pool factor. The pool factor is the ratio of the current outstanding balances to the original balances for the pool of mortgages. The lower the pool factor, the greater the refinancing that is assumed to have already occurred, and, hence, the greater the refinancing burnout.

Mortgages subject to higher default rates, such as those to low income families, will have higher prepayment rates due to higher default rates.

Basic housing turnover rates have averaged 5-6% per year. However, a strong housing market implies a higher turnover rate and a weak housing market, a lower turnover rate, all else being equal. Thus, prepayment rate models based solely on interest rate trends and expectations may overstate or understate prepayment rates.

The level of rates, demographic trends such as the number of 18-34 year olds and economic conditions influence the amount of first time home buying and “trading up.” For example, higher rates will increase the effective price of houses and higher consumer debt levels, and unemployment and lower wage increases will decrease affordability, resulting in lower turnover. Models can be developed to reflect macroeconomic and demographic forces impacting turnover rates.

A drop in property values can prevent prepayment, since refinancing is prevented. However, any subsequent increase in property values may result in a sudden surge of prepayments. This phenomena needs to be considered carefully, for it can lead to unexpected and apparently anomalous results. Suppose there is a large drop in rates accompanied by a large drop in values followed by a modest increase in rates and a large increase in values. Prepayments may not accelerate much during the period when rates are falling. And they may accelerate during the subsequent increase in rates. Prepayment rates are, thus, a function of property values.

Mortgages that collateralize GNMAs allow borrowers to transfer their loan to new buyers of the mortgaged property intact. When rates rise, the rate at which mortgages are assumed by new buyers increases, since they are, in effect, taking over a below market rate mortgage. The impact of assumability decreases the greater the gap between the property value and the mortgage balance. Conventional mortgages are paid off to the lender on sale of the property and so although increasing rates might inhibit property sales and hence result in slower prepayment rates, they would not be subject to the “double wammy” of GNMA collateral due to its “assumability.”

A drop in refinancing costs may occur during a period of declining rates because of competitive pressures to retain old business and attract new business. If expected prepayments were projected

on a 200 basis point refinancing cost and refinancing costs shrink to 50 basis points or less, these expectations can grossly underestimate the actual prepayments. Prepayment rates are, thus, a function of refinancing costs.

An unexpectedly and persistently steep yield curve can also lead to more rapid refinancing as people refinance simply to move down the curve to shorter term mortgages and much lower yields. Prepayment rates are, thus, a function of the shape of the yield curve.

Prepayment risk can be reduced by utilizing collateral backed by 15-, seven-, and five-year term balloon mortgages, the shorter the term the better, or mortgages with current or below current coupon rates, the lower the rate the better. Prepayment rates are, thus, a function of the average term and amortization period and average rate of the mortgage pool. The seasoning or average time since issue is also an important factor in assessing prepayment rates, as is the time of year and the level of home owner equity. In a typical mortgage pool, the prepayment rate is initially low, increases over time, reaches a peak and then remains level. Home buying and hence prepayment rates increase in the spring, peaks in late summer and declines in the fall and winter. Prepayment rates can also vary by mortgage issuer (underwriting, etc.), geographical location (local economy, etc.) and other factors.

Penalties paid to the lender at the time of prepayment are not allowed on U.S. residential mortgages. Traditionally, an up-front fee of about 2% of the mortgage balance provided some compensation for prepayment losses and disincentive to refinance.

Many prepayment models used in the U.S. in the 1991-93 period were based on the 1985-87 experience. This led to serious underestimation of prepayments in the 1991-93 period, when aggressive pursuit of refinancing by mortgage brokers had virtually eliminated both economic (up-front fees) and inconvenience disincentives to refinancing. Also, models generally failed to take account of the fact that refinancing to shorten the mortgage term was very attractive to borrowers in a steep yield curve, even when there was little or no actual change in rates.

In a Canadian NHA single family residential mortgage MBS (pool prefix of 964 or 967), the underlying mortgages will typically have a term of five years with no prepayment rights in the first year. A penalty based on the greater of a market value adjustment and one month of penalty interest will typically apply, if prepaid in full in the first three years. Non-profit housing mortgages have no prepayment privileges. The maximum penalty legally allowed on all single family NHA MBSs is three months of interest, if prepaid after three years.

Unscheduled full prepayment of NHA insured single family residential mortgages should be negligible in the first year, since full prepayment is not allowed. A surge of full prepayments can be anticipated just after the third year, when penalties are capped at three months interest. Prepayment experience will vary considerably depending on what phase the pool is in.

Typically, residential mortgages provide for partial prepayments without penalty. For example, the borrower may be able to prepay 10% of the original loan once a year without penalty. The borrower may be able to pay up to double the normal monthly payment each month without penalty. The borrower may be able to prepay without penalty under certain circumstances in the event that the mortgaged property is sold.

In the past it has been typical for dealers to assume that a new NHA single family residential MBS issue will have partial prepayments at a rate of 1% annually and full prepayments at a rate of 4% annually, until maturity. Prepayments should be adjusted to take account of housing activity, pool prepayment history and pool characteristics such as the weighted average coupon, the time to maturity, geographical location and concentration. Also, the exact prepayment terms and conditions and the prepayment experience vary considerably by issuer.

The longer term of the typical U.S. residential mortgage compared to the typical Canadian mortgage and the absence of prepayment penalties on U.S. mortgages makes the prepayment and risk extension of U.S. MBSs very much greater than that of Canadian.

Collateralized Mortgage Obligations

The first U.S. collateralized mortgage obligations (CMOs) was issued in 1982. The collateral for a CMO can be one or more pass-throughs or a pool of mortgages. The great innovation of CMOs arises from the fact that the pooled cash flows can be carved up into tranches that meet the investment needs of a wide range of investors, thus attracting wide interest in securitized mortgages. This gave a huge boost to the securitized mortgage market. In 1993, there were $271 billion of CMOs issued. Today, about three quarters of the agency MBS issues are turned into CMOs.

Initially, CMOs were issued as sequential tranches. While all tranches received interest payments, all principle payments were initially directed to the first tranche. Principle payments to the next tranche would kick in when the cash flow entitlements of all the preceding tranches were exhausted. The first tranche is a shorter term security than the second and so on. Typically, there were only five to seven tranches with the final tranche referred to as the Z tranche or accrual bond. In the case of the Z tranche, interest accrues on tranches until the payments are completed on all preceding tranches. Any difference between the total cash flow generated by the pool of mortgages and the payments to the various tranches due to differences in coupon rates between tranches, over collateralization, reinvestment of income prior to payout, is paid to the "residual tranche."

In the prospectus for each agency-guaranteed pool, there are tables listing each tranche showing examples of how cash flows from each tranche change under a wide range of interest rate and prepayment scenarios. Under a zero prepayment assumption, a tranche could have an average life of 30 years. The same tranche could have an average life of six months, if prepayments were several times the standard rate.

The first Canadian CMO issue was in April 1993. A total of 12 NHA CMO issues have been done to the end of 1994. The CMOs typically use several MBS issues as collateral, resulting in good issue size and diversification. The first seven CMOs were done as private placements. Subsequent CMOs have received exemptions from private placement status due to the NHA MBS security. There has only been one non-NHA residential CMO to date. The additional complexities and increased investor risk concerns with non-NHA are likely to mean that few non-NHA CMOs are likely to be issued.

The shorter term of the typical Canadian residential mortgage lends itself to a much simpler CMO structure than that in the U.S. The typical structure has only a few tranches. One tranche receives all prepayments until a level of 10% of principal prepayments has been reached, say. A second tranche is then allocated all subsequent principal prepayments, until they reach 20%, say. A third tranche would be allocated any principal prepayments beyond this level, if any. A fourth "residual" tranche would be interest only and receive any difference between the total amount of interest paid on the underlying MBS and the total interest paid on the other three tranches. This structure leverages the prepayment risk to the earlier tranches leaving virtually none to be borne by the third tranche. Only one issue has involved a single principal-only tranche.

Penalty payments for early prepayment could be included in fourth tranche, could be sold as a separate tranche or could be allocated to the first three tranches as prepayments are incurred by them. All Canadian CMOs to date have passed penalty interest through to the residual tranche.

Planned Amortization Class (PAC)

The Tax Reform Act of 1986 made possible a new trust vehicle, the Real Estate Mortgage Investment Conduit (REMIC), which made possible the issuance of CMOs with multiple bondholder classes without adverse tax consequences. In 1986, the first CMO planned amortization class (PAC) was issued. A CMO involving PACs can have 70 or more tranches.

A PAC is designed to give more protection from both prepayment and extension risk than available through a sequential CMO or even a straight MBS. The Public Securities Association has defined a standard prepayment rate referred to as 100% PSA. The constant prepayment rate (CPR) is the annualized rate of unscheduled prepayments per month. The standard rate is defined to be .2% CPR in the first month increasing by .2% per month for 29 months to 6% CPR after 30 months. A CPR of 6% means that the prepayment for month t equals $(1 – (1 – .06)1/12)$ times the mortgage balance at the beginning of the month reduced by the scheduled principal payments.

The average seasoned 30-year conventional mortgage with current coupon has prepaid around 125% to 140% PSA depending on whether the mortgage is assumable or not. Falling rates cause a significant increase with rates as high as 1300% PSA experienced on some CMOs in 1993. Rising rates cause a significant slowing in rates that is especially pronounced, if the loan is assumable and housing prices have appreciated little since origination. These “ballpark” rates are subject to much variation due to the many factors other than general rate level that impact prepayment rates that have been previously noted.

The payments to an investor from a PAC are fixed (based on some prepayment rate such as 160% PSA), as long as prepayments are neither excessively rapid nor excessively slow. The protection provided by the PAC is expressed in terms of a band of PSA percentages such as 80% PSA to 300% PSA. The PAC will receive exactly the scheduled payments, provided that the prepayment rate is a fixed percentage of the PSA rate and this rate lies within the band. The wider the band, the greater is the protection at origination. However, the effective protection on a seasoned PAC can be much greater than or much less than the PAC bands at origination as discussed below.

The PAC tranches receive protection at the expense of non-PAC tranches referred to as support or companion bonds. Support bonds bear leveraged prepayment and extension risk. A typical “long companion” bond has cash flow variation under a range of interest rate scenarios that is similar to that of a 30-year bond, callable in one year. Support bonds must absorb all prepayments in excess of those required to meet the fixed PAC payments. If prepayment is too rapid, the principal on the companion bonds is entirely paid off and the PAC must absorb all further principal payments. If the prepayment protection is breached in this way, the PAC is said to be busted. If prepayment is too slow, the support tranche will receive no principal payments and the PAC may receive less than the scheduled principal payments.

Support tranches make up 25% or more of a pool. A single pool may have 10 or more PACs with different terms and sequenced schedules of principal payments and with varying degrees of protection. In this situation, the shorter the term of the PAC (i.e., the earlier it is in the sequence of PACS), the more protection it has against fast prepayment. Even when prepayment is more rapid than the upper bound of protection on the earlier PAC tranches, the relatively shorter term PAC may still receive payment as per schedule. The reason for this is that all the support bonds established for all the PACs must be paid off before the earlier PAC tranches must begin absorbing excess principal prepayments.

If a PAC has an upper band of 300% PSA, there are sufficient support bonds to absorb all principal payments made should they be made at the level of 300% PSA from the outset and throughout the term of the PAC. The fact that prepayments are at a rate of 500% PSA for a while does not necessarily mean that the PAC will receive unscheduled principal payments. Unscheduled payments will be borne by the PAC only if the principal payments of the support bonds have been entirely paid off.

Should prepayments persist from the outset at a level materially below the 300% PSA level, the protection afforded by the support bonds effectively rises above the 300% PSA level, since materially fewer principal payments than allowed for have been made and these are available to absorb future prepayments above the 300% PSA level.

The initial bands of PAC protection do not provide a good indicator of the effective protection available to a seasoned PAC. A wider original band on a seasoned PAC does not necessarily mean greater protection. A PAC with a narrower band may have substantially greater effective protection from rapid prepayment than indicated by the upper band, since prepayment rates substantially below the upper bound may have prevailed for a long period of time. An extended period of prepayments slower than the lower bound of the PAC will raise the effective lower limit of the PAC.

If the prepayment rate is always a constant percentage of the PSA and the percentage is within the bands, the payment schedule can be met. However, it is possible for the schedule not to be met and the PSA never to fall outside the band. This could happen if the PSA rate varied. A long period at or near the upper bound of the PSA band raises the effective lower bound above the initial lower bound. Should the PSA rate fall below the effective lower bound while remaining above the initial lower bound, the principal payments would be less than scheduled even though the original band range is never violated.

Varieties of CMOs

There is a virtually unlimited variety of types of CMO securities: principal-only (PO), interest-only (IO), super POs (POs carved out of support tranches), super IOs, targeted amortization class TACs, very accurately determined maturity VADMs, floaters, inverse floaters, super PO inverse floaters, IOettes, inverse floating IOs, tier-two PACS, etc. When the collateral for a CMO are themselves securities such as POs, IOs and other CMOs, the CMO is called a “kitchen sink” bond.

In 1987, stripped MBSs were first issued by allocating all interest to one class (IO) and all principal to another (PO). IOs and POs can be created from any CMO tranche. The PO is sold at a substantial discount. The yield on the PO is higher, the faster the prepayment, and vice versa. Falling interest rates increase the price of POs, since prepayments increase with falling rates.

When interest rates drop, principal payments accelerate; the outstanding balance decreases; the interest earned declines and the price of the IO declines. When the interest rates increase, the price of the IO increases for the converse reason. This pricing behaviour is the opposite to normal fixed income investments.

In 1986, floating rate CMOs, which reset the interest rate monthly, usually at the one-month interbank rate, were first issued. A floating rate CMO may receive interest at a rate higher than the fixed rate on the mortgages collateral as a result of increases in the floating index rate. Such excess interest can be paid out of any excess of interest paid on the total collateral over the interest paid on all other tranches. If this were the only source of excess interest, however, the floating rate would need to be capped at a relatively low level which would make it considerably less attractive to floating rate investors. A higher cap can be established by including an inverse-floating rate bond tranche, whose rate floats monthly, inversely to the one-month interbank rate. The principal balance of the floating and inverse floating rate bonds declines as principal is paid down on the tranche or tranches from which they are carved out.

The price of inverse floaters increases (decreases) with dropping (rising) rates because of the normal increase in value associated with fixed rate investments in a dropping rate environment and because the rate earned by the inverse floater actually increases. Conversely, the price of inverse floaters decreases rapidly in a rising interest rate environment.

An inverse floater will often be leveraged to the floating rate index. A coupon leverage of three means that a change in the index of 10 basis points has a 30 basis point impact on the inverse floater coupon payment. A superfloater is a floating rate CMO whose coupon leverage is greater than one.

An inverse IO receives interest based on the outstanding balance of a PO tranche, but the coupon rate varies inversely with a floating rate index. Inverse IOs decline in value as interest rates drop because of a decline in the balance on which interest is paid due to an acceleration of prepayments and increase in value as interest rates drop because the interest rate increases. Some investors concluded that these offsetting factors made inverse IOs naturally self-hedging. However, in a rapidly rising interest rate environment, the decline in value due to the drop in the inverse IO rate is far greater than the increase in value due to an unexpectedly high balance on which the principal is paid.

An IOette receives only interest and either a nominal amount of principal (for REMIC tax compliance purposes) or no principal. The interest derives from the so-called coupon differential (i.e., the difference between the interest actually paid to all the bond classes and the interest payments based on the highest coupon of all the bond classes).

A targeted amortization class (TAC) is like a PAC in that it has a schedule of payments that is protected from rapid prepayment. A support tranche absorbs principal payments in excess of those required to meet the TAC schedule. However, no protection is provided for slower prepayments.

Very accurately determined maturity VADM bonds have very stable cash flows. The only cash flow they receive derives from the accrual of interest on a Z tranche.

Once a tranche has been defined, it is possible to apply the same structures initially applied to carve up the pool, to the carving up of the tranche. Thus it is possible to take a PAC and to carve it into accrual bonds, floaters, inverse floaters, interest-only and principal-only and so to get PAC floaters, PAC inverse floaters, PAC IOs, etc. It is also possible to carve up support bonds in the same way. A principal-only or interest-only bond created from a support bond is a super PO or super IO. A PAC created from a support bond is a PAC II bond. It will have somewhat greater protection than other support bonds, but less protection than PAC I bonds. In particular, all PAC II bonds would be paid off before extra payments of principal would be allocated to PAC I bonds. This process can be applied again and again, once a new bond class has been created.

The Flux Measure Of Relative Cash Flow Variability

The NAIC has recently introduced the Flux score as a measure of prepayment risk for CMOs, to assist regulators in identifying those insurers whose holdings may need special attention. The flux score is a relative measure of cash flow variability. The score is calculated using a base interest rate scenario and five other scenarios. Differences in the cash flows and the present value of the cash flows are calculated in each scenario relative to the base scenario and the flux formula applied to get the flux score.

The flux score is duration neutral in the sense that a greater duration does not entail a higher flux score. A higher score implies greater variability, but a score that is twice as high does not imply twice the variability. Scores generally fall in a range from 0-30. The flux system is under development and it is not yet clear what constitutes a problematic score.

Flux scores vary considerably from one prepayment model to another. It is also possible for one prepayment model to produce a different ordering of CMO flux scores relative to another model.

5.4 The Mortgage-Backed Security (MBS) Issue Process

An insurance company with an interest rate risk problem determines that it can effectively reduce the problem by selling a pool of CMHC insured mortgages with a book value of $20 million and a book yield of 11% through the MBS process. It approaches a dealer that agrees on February 15 to price the MBS issue to yield 10% to the company. The MBS issue is sold by the dealer at a discount to investors effective March 1 with a coupon of 9.50% and a yield of 9.95%. The dealer pays the insurance company $19.8 million on March 15.

The insurance company receives the April 1 mortgage payment of principal and interest and makes the first MBS payment of principal and interest to the MBS investors on April 15. Subsequent amounts are received by the MBS issuer on the first of each month and paid to the MBS investor on the fifteenth of each month. The amounts paid to the MBS investor increase slightly each month due to the combined flow-through of an increasing principal amount from the scheduled principal repayments of the securitized mortgages and a decline of interest each month on the outstanding mortgage balance.

The present value of the amount paid by the dealer to the company equals the present value of the payments made by the company on the MBS issue assuming no unscheduled prepayment of principal, on the securitized mortgages, where the value is determined on March 1 and the discount rate is 10%. The dealer has bought the MBS cash flow stream to yield 10%. It sells this same stream of cash flows to yield 9.95%. This five basis point spread is about $140,000 and equals the difference between the amount paid by investors to the dealer and the smaller amount paid by the dealer to the company.

For the $140,000, the dealer takes all interest rate risk commencing on February 15, when it committed to the issue to yield 10%. It buys the deal, guaranteeing the sale to the company, and finds the needed investors through its distribution system. The insurance company incurs a number of issue expenses amounting to about $30,000 and continues to incur administrative costs for the mortgages.

The MBS investor receives interest at 9.50% on the outstanding mortgage balance together with scheduled and prepaid principal amounts. The MBS investor may or may not be entitled to some or all of any prepayment penalties paid by the mortgage borrower. However, the MBS investor bears the prepayment risk.

The purchase of the issue at a discount is some compensation to the MBS investor for bearing the early prepayment risk, since an early prepayment of principal will result in an early realization of a proportionate share of the discount and hence an increase in yield. If the investor did not bear this prepayment risk, the arrangement would not likely be accepted as an actual divestment of the mortgages for financial reporting purposes.

The insurance company records a loss on the sale of the mortgages of $230,000 ($200,000 discount to book value plus $30,000 expenses) even though the book yield of 11% exceeds the effective sale yield of 10%. This loss is amortized over the remaining term of the mortgages in accordance with Canadian insurance company accounting. The loss brought into income each accounting period is more than offset each accounting period by the income received on the mortgages at 11% and the payout of the MBS interest at 9.50%. In this way, the income from the sale is accounted for only as it is earned. Other less conservative accounting procedures, which capitalize some of the expected spread income, may be acceptable, especially in noninsurance financial companies.

The expected income from the spread between the mortgage rate and the MBS coupon will be reduced if there are unscheduled prepayments of principal. In the event of default, this entire spread is lost for the remaining term of the mortgage, even though the mortgage is CMHC insured.

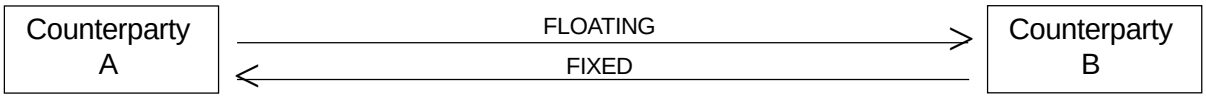
CHAPTER 6 – INTEREST RATE SWAPS

6.1 Interest Rate Swap Terms

An interest rate swap is an exchange of one or more payments between two counterparties, at specified times, for a specified period of time. The payments are calculated as a percentage of principal amount according to the swap agreement. The principal amount is not an obligation of either party. It is simply the basis on which payments are calculated. At the end of the swap term, payments simply cease. Since the principal amount is typically not exchanged, this amount is referred to as the notional principal amount.

The size of the notional principal amount can range from one million to billions of dollars and the term from one to 50 years. Swaps are highly liquid up to five years and increasingly illiquid and infrequent beyond 10 years. Swaps can be written for odd dates and uneven amounts relatively easily.

Interest Rate Swap



In a typical swap, counterparty A agrees to make periodic floating rate payments for the term of the swap to counterparty B in return for the receipt from B of periodic fixed rate payments. The floating rate is determined by a market index such as one-, three- or six-month LIBOR, 30-day commercial paper composite rate or three-month banker's acceptance rates. The floating rate is reset on each date that a floating rate payment is made.

Floating payments are made at the end of each period based on the floating rate at the beginning of the period. In an "in-arrears" swap, the floating payment is made at the end of the period based on the rate at the end of the period.

The floating rate is usually based on a short-term index, but this is not essential. In the case of a constant maturity swap, the floating rate could be paid every six months, say, based on the then current five-year Canada bond rate. Also, the floating rate could be based on more than one index (greater, average, lesser of two).

Fixed and floating payments need not be exchanged on the same dates. Fixed rate payments might be made semi-annually, and floating rate payments made quarterly, for example. Mismatched payment swaps are uncommon, since they involve greater credit risk and may have adverse tax consequences if the counterparty is foreign. In a zero-coupon swap, one counterparty might make periodic payments throughout the life of the swap but receive only a single payment predetermined at swap inception or maturity. In the extreme, a single payment is exchanged at maturity representing the net economic value of the fixed and floating cash flow streams.

In a semi-fixed swap, fixed payments are based on more than one fixed rate. The lower of the fixed rate might be paid if the floating rate is below a certain rate and the higher fixed rate is paid, otherwise.

In a basis swap, one counterparty pays one floating rate index in exchange for another floating rate index in the same currency. A yield-curve swap is a basis swap in which floating indices based on different points in the yield curve are exchanged. Counterparty A could agree to pay the two-year constant maturity Canada bond rate in return for the receipt from counterparty B of the five-year constant maturity Canada bond rate. Payments occur every six months for ten years, say. Counterparty A might believe the yield curve will steepen between two and five years and counterparty B that it will flatten. A "diff" swap involves the exchange of floating rate payments based on two different floating indexes denominated in different currencies.

An index amortizing swap has a notional principal amount that decreases with the level of the floating rate. Usually, the amortization schedule slows down (speeds up) as rates rise (fall). This makes their interest rate sensitivity similar to investments, such as mortgage-backed securities, that are sensitive to prepayment risk. An accreting (step-up) swap has a notional principal amount that increases according to a pre-set schedule or pre-defined formula. Certain currency swaps involve a pair of notional principal amounts.

A swap spread lock fixes a swap spread over government bonds at the outset or at some point during an initial period. A swap at that spread must be entered into at some point in the future, unless the replacement cost is paid between the counterparties to unwind the commitment.

An accrual interest rate swap involves the payment of a floating rate, such as LIBOR, in exchange for the floating rate plus a large spread. However, the latter interest payment only accrues on days in which the floating rate is between an upper and lower bound.

6.2 Classic Debt Management Uses of Interest Rate Swaps

Originally the swap market was used to arbitrage between different credit spreads available in different segments of the capital markets. The classic swap situation involves a strong (AAA) bank that is able to issue fixed rate debt in the public market at advantageous rates, but wishes to raise floating rate funds as part of its treasury funding operations. It also involves a weak (BBB) corporate entity that is unable to raise fixed rate term debt at an attractive cost, but is able to borrow on a committed basis through a banking facility at a relatively narrow margin over a floating rate index. These two parties have complementary requirements.

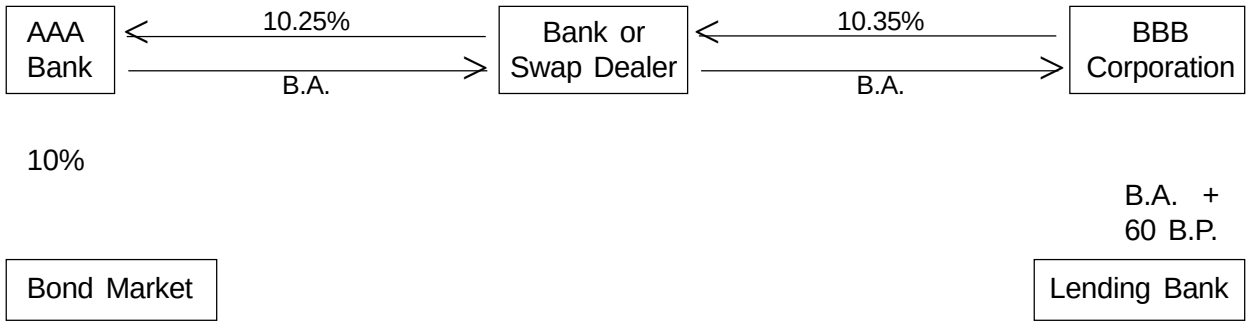
Through an interest rate swap, both parties may be able to borrow in their favoured debt markets at a cost that is cheaper than doing so directly. This is because typically fixed rate bond markets have tended to require a much wider quality spread between high and low quality borrowers than is typical of floating rate markets. If the strong and weak counterparties raise funds in the market in which they have a relative advantage, the resultant interest rate payments can be swapped to achieve cheaper funding for both.

The (AAA) bank might be able to issue a floating rate note at an all-in-cost of three-month banker acceptances (BAs) plus 25 basis points. Alternatively, it might be able to issue five-year fixed rate bank paper at 10.00% and to do a five-year swap in which it pays the BA rate and receives a fixed rate of 10.25%. The net fixed payments of plus 25 basis points reduces the floating swap payments. The net floating rate cost (reduced by the net 25 basis points) to the bank is BAs less 25 basis points.

The weak (BBB) corporation might be able to do a private placement at 11.25%. Alternatively, it might be able to borrow on a floating rate basis at BAs plus 60 basis points, and to do a five-year swap to pay 10.25% and receive the BA rate. The net floating payments of plus 60 basis points increases the fixed swap payments. The corporation's all-in fixed rate cost is 10.85% (10.25% plus .60%).

It could well be the case that the AAA bank would not commit to long-term lending to the BBB corporation at BAs plus 60. A bank with a lower credit rating might act as lending bank. The corporation might find another swap bank or dealer that would agree to receive a fixed pay swap at 10.35% from the BBB corporation. The swap bank or dealer would also agree to pay a fixed pay swap at 10.25% to the AAA bank. The swap bank or dealer would earn a spread of 10 basis points and the all-in-cost of the fixed rate debt to the BBB corporation would increase to 10.95%. The situation can be depicted as follows:

A Classic Interest Rate Swap



The AAA bank raises floating rate debt at 50 basis points (BAs +25 basis points versus BAs –25 basis points) less cost than its floating rate note alternative. The BBB corporation raises fixed rate debt at 30 basis points (11.25% versus 10.95%) less cost than its private placement alternative.

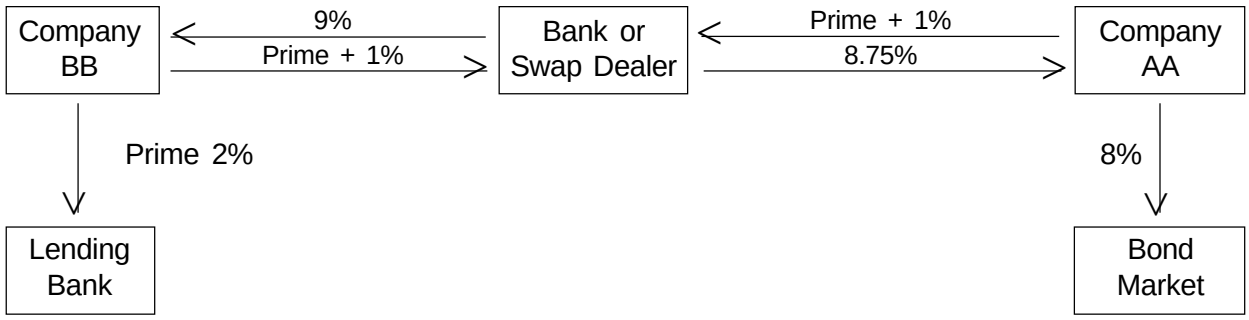
This classic interest rate swap alternative arises because there is 125 basis points difference in the fixed rate borrowing costs of the AAA bank and BBB corporation and only 35 basis points difference between their floating rate borrowing costs. The arbitrage potential of 90 basis points (125 basis points versus 35 basis points) is shared 50 basis points to the AAA bank, 30 basis points to the BBB corporation and 10 basis points to the swap bank or dealer. There is no change in the situation from the perspective of the bond market investors lending to the AAA bank and the lending bank lending to the BBB corporation.

Interest rate swaps can also be used to provide lower rated corporations with indirect access to the fixed rate bond markets. A BB company might not have access to the bond market because of its low credit. It might be able to borrow from a bank on a floating rate basis at prime +2%. It might also be able to enter into a five-year swap with a swap dealer to pay 9% fixed and receive prime +1%. In effect, the BB company has sourced five-year money at a fixed rate of 10%.

The swap dealer might be able to do a five-year swap with a AA company to pay fixed at 8.75% and receive prime +1%. Net of its swap with the BB company the swap dealer earns 25 basis points for five years in return for taking on the counterparty exposure to the BB and AA companies.

The AA company raises five-year money in the bond market at 8%. The swap to receive 8.75% locks in a net fixed positive spread of 75 basis points. It pays the swap dealer prime +1%, which is prime +25 basis points, net of the positive 75 basis point spread. If it usually borrows at prime +50 basis points, the AA company raises floating rate funds at 25 basis points under its normal costs.

A Classic Interest Rate Swap



See Appendix 1 on factors impacting the swap spread for more information on swaps.

6.3 Managing Portfolio Interest Rate Risk Using Interest Rate Swaps

Interest rate swaps can be used to manage portfolio duration. The simplest way of understanding the potential duration impact of an interest rate swap is by extension of the law of one price. According to this law, two portfolios that result in the same cash flows in each and every interest rate and economic scenario must have the same price. This law is the foundation for arbitrage-free pricing, since an arbitrage opportunity will exist between one portfolio and another, if they give rise to identical cash flows under all circumstances, but their prices differ. Risk-free profit can be made by shorting the more expensive portfolio and using the proceeds to buy the cheaper portfolio.

The floating rate side of an interest rate swap can be decomposed into a series of forward contracts on the floating rate index. The total price of the floating rate side of a swap is equal to the price of this series of forwards. This price must be the same as the price of the fixed rate side of the swap. In a similar fashion, two portfolios that give rise to the same cash flows under all circumstances must have the same duration. This could be termed the "law of one duration."

The net cash flows resulting from the sale of a five-year term fixed rate bond with a coupon of 8% and the purchase of a five-year floating rate bond to pay BAs with the same par value are identical to the net cash flows resulting from a five-year swap to pay 8% and receive BAs. While there are default situations where the net cash flows differ (as between different bond issuers or between different ranking financial obligations of the same issuer), this nicety will be ignored. Accordingly, the law of one duration dictates that the duration impact of the one portfolio consisting of a long and short bond position is equivalent to that of the interest rate swap.

The duration impact of a five-year term floating bond to pay three-month BAs, should be the same as that of a portfolio of three-month BAs, by a further application of the law of one duration. Once again, liquidity, supply/demand and credit subtleties that make these portfolios less than perfectly equivalent under all circumstances are ignored. Consequently then, the duration of a floating rate bond at the commencement of each floating rate period, based on three-month BAs, is simply .25 years (three months).

The duration impact of a five-year fixed pay swap to pay 8% can be incorporated into the asset portfolio by including a notional negative (short) five-year term bond position at 8% and a positive BA position with a duration of .25. The bond amounts are both equal to the swap notional principal amount and net out. The duration impact will change with the passage of time due to the shortening of the remaining term to swap maturity and the time to the next resetting of the BA rate on the swap. The duration impact of a five-year fixed receive swap to receive 8% can be handled in an analogous way.

There are several situations in which an interest rate swap might be entered into in preference to a repositioning of the bond portfolio done simply to reduce interest rate risk. The realization of capital gains or losses upon sale of bonds could have adverse tax or financial reporting implications. The required bond repositioning may interfere with the portfolio or trading strategies of the bond portfolio manager. It may not be possible to liquidate sufficient bonds in a cost-effective, expeditious manner. Opportunity costs in holding a large money market position may be prohibitive.

The wholesale swap market and the retail residential mortgage and GIC markets do not always move in tandem. The mortgage (GIC) spread may be wide (narrow or negative) relative to the fixed swap rate based on historical relations. Mortgages (GICs) can be aggressively sought (sold) in these situations without immediately acquiring offsetting GICs (mortgages). The offsetting GICs (mortgages) may not be immediately available or they may not be available at an attractive price. The mismatch risk from excess mortgages (GICs) is eliminated by entering into interest rate swap transactions to pay (receive) fixed. In effect, the swap locks in the abnormally wide (narrow) mortgage (GIC) spread, until such time as GICs (mortgages) can be found.

This use of interest rate swaps parallels the use of Canada bonds and money markets instruments to hedge mortgage and GIC inventories. The decision to use a swap or cash market solution will be primarily spread-driven. If the fixed rate swap spread relative to Canada bonds is relatively wide, based on historical relations, then agreeing to receive the fixed swap rate will be preferred to purchasing a Canada bond. If the fixed swap rate relative to Canada bonds is relatively narrow, based on historical relations, then agreeing to pay the fixed swap rate will be preferred to selling Canada bonds. Should the swap rate revert to historical norms by the time the swap needs to be unwound, swap spreads are likely to have moved in the insurer's favour.

The choice between Canada bond and interest rate swaps has considerable importance. No one strategy is always best. The five-year swap spread relative to five-year Canada bonds has ranged recently from a high of 120 basis points in 1990 to a low of 15 basis points in 1993-94.

Hedging a Rate Crediting Strategy

A universal life, single premium deferred annuity or other policy might require a rate crediting strategy linked to current five-year government bond rates. A portfolio of cash market investments designed to support such a rate in a stable or falling interest rate environment may fail to do so in a rising interest rate environment because the portfolio rate lags behind current new money five-year rates. Put options or a cap on five-year government bonds could be purchased to hedge against rising five-year rates. Alternatively, a five-year constant maturity swap could be used.

In a five-year constant maturity swap, the insurer agrees to pay a rate fixed for the life of the swap (which need not be five years) in exchange for a floating rate payment that resets every period based on the then current five-year rate. In a rising interest rate environment, such a swap will blend with the cash market portfolio rate to produce a combined rate that tracks new money five-year rates much more closely. Such a swap will be more cost-effective than put options or a cap, since with the swap, the insurer does not pay for protection from, and consequently bears, the downside risk in a declining interest rate environment.

Liquidity Risk

It is important to recognize that extensive use of swaps to manage interest rate risk can lead to major cash flow mismatches even in situations where portfolios are closely duration matched. While an interest rate swap to pay fixed and receive BAs is equivalent to selling five-year bonds and holding BAs from an interest rate perspective, it is not equivalent from a liquidity perspective. Reliance on swaps to manage interest rate risk requires additional vigilance with respect to liquidity.

A portfolio consisting of illiquid five-year bonds and mortgages combined with fixed pay swaps may have similar interest rate risk to a one-year GIC. However, should the one-year GIC be withdrawn at maturity, it may not be possible to liquidate the supporting portfolio in a cost-effective, expeditious manner. Ensuring adequate liquidity should be a priority.

6.4 Hedging Specific Liabilities With Interest Rate Swaps

Assume $50 million of five-year term monthly pay RRSP sales occur on February 28, at 7.5%. They are priced assuming a mortgage rate of 9.5%. However, no mortgages are available until May 28, when $50 million of five-year mortgages are funded at 9%. If the liabilities are not hedged, the actual profit will be 50 basis points less than assumed in the original pricing.

Suppose the $50 million of excess five-year term liabilities are hedged by doing a $50 million five-year term swap to receive fixed at 8.25% on February 28. The RRSP deposits will be invested in BAs to support the floating rate payments required by the swap. When the $50 million of five-year mortgages are funded on May 28, an offsetting $50 million five-year term swap to pay fixed would be done.

Then, if the fixed swap rate decreases by 50 basis points, as did the mortgage rate (9.50% – 9.00%), the offsetting swap will require fixed payments at 7.75% (8.25% – .50%). The floating side of the swaps are both BA rates and so they net to zero. The hedging and offsetting swaps combine to produce a net payment to the company of 50 basis points. When combined with the 9% mortgage rate, a fixed rate of 9.50% is achieved. This is the rate assumed in the pricing of the RRSP sales. In practise, the funding of the $50 million of mortgages may be spread over several weeks instead of all occurring on May 28. This is handled by entering into a series of offsetting swaps in amounts equal to the amount of mortgages funding at each point in time. The offsetting swaps would total $50 million.

There is a loss of spread between February 28 and May 28 between the mortgage rate of 9.50% and the fixed rate of 8.25% received on the swap. Spread over the five years, the spread loss amounts to approximately seven basis points. The loss would be less if a portion of the assets assumed in the pricing were lower yielding or if the mortgages funded before the full three months. This “hedging loss” should be reflected in pricing.

There is potential for loss (gain) in that the fixed rate on the hedging instrument need not move in lockstep with mortgage rates, the so-called basis risk. In particular, the fixed swap rate on May 28 may have decreased by 40 basis points to 7.85%. Now the company receives fixed of 8.25% and pays fixed of 7.85%, for a net received spread of 40 basis points. Since mortgage rates dropped by 50 basis points, there is a net loss of 10 basis points, because of the change in spreads between mortgages and swaps, while the hedge was in place. The example assumes that the mortgages funded on May 28 were duration-matched to the liabilities sold on February 28. The interest rate sensitivity of the five-year swap is similar to that of five-year mortgages, which is, in turn, similar to that of the five-year monthly pay GICs. Variations in the spreads between five-year GICs, five-year mortgages and five-year swaps mean that some interest rate risk remains.

A larger notional principal amount of five-year term swaps would be needed to hedge five-year compound GICs, since the five-year compound GIC duration is greater than that of a five-year bond and, hence, greater than that of a five-year swap. A simple calculation will determine what notional principal amount of five-year swaps will duration-match the five-year GICs sold.

A more serious complication arises if the mortgages funded do not “match” the GICs sold. If the mortgages are one year in term at a rate of 7% say, it would not be appropriate to do offsetting five-year swaps to pay fixed at 7.75%. Instead, a one-year swap to pay 6.75% might be entered into. This would lock-in a net positive spread of 150 basis points on the swaps for the first year (8.25% receive, 6.75% pay).

The achieved first year gross spread would be reduced from 150 basis points to 100 basis points, as a result of having to pay 7.50% on the five-year GIC and receiving only 7% on the one-year mortgage.

While the first year spread is narrow, it may represent a satisfactory spread in the light of forward rates. In particular, if the one-year mortgage matures and is reinvested in a four-year mortgage and a four-year swap entered into at the time, then a satisfactory spread may be achievable over the full five-years of the GICs. If the spread between the one-year forward four-year mortgage rate and the one-year forward four-year swap rate prevailing on May 28 equals the spread actually achieved one year hence, then the spread will be satisfactory. The potential for loss (gain) represents a basis risk.

6.5 Hedging Specific Assets With Interest Rate Swaps

Assume $50 million of five-year mortgages are funded on November 28, at 9.50%. Sales of RRSP GICs are priced at this time assuming this rate. However, no sales are made until February 28, when $50 million of five-year term, monthly pay GICs are sold. These sales are priced using the 10% rate on five-year mortgages applicable on February 28. If the assets are not hedged, the actual profit will be 50 basis points less than assumed in the pricing.

The $50 million of excess five-year assets can be hedged by doing a $50 million five-year swap to pay fixed at 8.25% on November 28. The fixed pay rate is supported by the 9.50% earned on the mortgages. When the $50 million of RRSP sales are completed on February 28, an offsetting $50 million swap to receive fixed is done.

If the fixed swap rate increases by 50 basis points, as did the mortgage rate (9.50% – 10.00%), then the offsetting swap will involve fixed receipt of payments at 8.75% (8.25% – 8.75%). The floating side of the swaps are both BA rates and so they net to zero. The hedging and offsetting swaps combine to produce a net payment to the company of 50 basis points. When combined with the 9.50% mortgage rate, a fixed rate of 10.00% is achieved. This is the rate assumed in the pricing of the RRSP sales.

In practise, the RRSP sales may be spread over several weeks, instead of all occurring on February 28. This is handled by entering into a series of offsetting swaps in amounts equal to the amount of sales occurring at each point in time. The offsetting swaps would total $50 million.

There is a pick-up in spread, between November 28 and February 28, between the mortgage rate of 9.50% and the rate of 8.25% paid on the swap. Spread over the five years, the spread profit amounts to approximately seven basis points. This “hedging gain” could be reflected in pricing.

There is potential for loss (gain) in that the fixed rate on the hedging instrument need not move in lockstep with mortgage rates, the so-called basis risk. In particular, the fixed swap rate of February 28 may have increased by 40 basis points to 8.65% (8.25% – 8.65%). Now the company receives fixed of 8.65% and pays fixed of 8.25% for a net received spread of 40 basis points. Since mortgage and GIC rates increased by 50 basis points, there is a net loss of 10 basis points, because of the change in spreads between mortgages and swaps, while the hedge was in place.

The example assumes that the GICs sold on February 28 were duration-matched to the assets funded on November 28 and were duration-matched to five-year swaps. The notional principal amount of the hedging swap could be adjusted to ensure that the product of the amount and the swap duration equalled that of the product of the asset market value and duration.

A more serious complication arises, if the GICs sold do not duration-match the assets funded. If the GICs are one year in term at a rate of 6%, say, then it would not be appropriate to do offsetting five-year swaps to receive fixed at 8.75%. Instead, a one-year swap to receive 6.50% might be entered into. This would lock-in a net negative spread of 175 basis points on the swaps for the first year (8.25% pay, 6.50% receive). The achieved first year gross spread would be increased from –175 basis points to +175 basis points, as a result of having to pay 6% on the one-year GIC and receiving 9.50% on the five-year mortgage.

If the one-year GIC matures and is rolled into a four-year GIC, a four-year swap can be entered into at the same time. If the spread between the one-year forward four-year GIC rates and the one-year forward four-year swap rates prevailing on February 28 equals the spread actually achieved one year hence, then the spread achieved over the five-year term of the assets should be satisfactory. The potential for loss (gain) represents the basis risk.

6.6 Use of Interest Rate Swaps to Broaden Investment and Marketing Opportunities

Interest rate swaps can be used to overcome unattractive features of an otherwise attractive asset or liability. They can thereby broaden investment and marketing opportunities.

Suppose a cheap five-year term, floating rate bond paying BAs plus 60 basis points could be bought, but all liabilities were five-year fixed rate. The investment is cheap and, therefore, desirable, but floating rate, and, therefore, inappropriate to support the fixed rate liabilities.

A five-year term interest rate swap to pay BAs and to receive a fixed rate of 8%, could be purchased along with the floating rate bond. In combination, the bond and swap result in a fixed rate of 8.60%. Since the floating rate bond is cheap, the rate of 8.60% may be quite attractive. This would be especially true if excess demand for five-year investments had caused five-year fixed rate spreads to narrow and an excess supply of floating rate investments had caused the floating rate spread to widen.

Suppose a five-year asset can be sold either directly or in an MBS issue at an attractive rate, but fixed rate assets are needed to support liabilities. The sale proceeds can be invested in BAs and a five-year swap to pay BAs entered into. The fixed swap rate received will provide protection against a drop in rates until the BAs are liquidated to fund new five-year investments. This might be an especially attractive process if the company can source more five-year assets than it can use in support of its liabilities.

Suppose a five-year asset is available at an attractive rate, but a three-year asset is needed to support liability sales. The company could enter into a five-year swap to pay fixed and a three-year swap to receive fixed, or equivalently, it could enter into a three-year forward two-year swap to pay fixed. The swaps convert the final two years of the five-year fixed rate asset into a floating rate, thereby eliminating the interest rate risk arising from the term mismatch. Swaps could also be used to handle the situation where the available assets have a term shorter than that needed to support liability sales.

The spread difference between the three- and five-year swaps need to be combined with the spread difference between the five-year asset and three-year liability to determine what rate is locked in for the three-year period.

In a positive yield curve environment, the rate paid on the five-year swap will exceed the rate received on the three-year swap. This loss of spread may or may not be offset by the excess spread on the five-year asset relative to that assumed in pricing the three-year liability.

There is also the risk that after three years, the spread locked in by the five-year asset and five-year swap may not be satisfactory. In particular, if a two-year swap to receive fixed is entered into in three years, a positive or negative spread will be earned between the fixed spread received and the fixed spread paid on the original five-year swap. If this spread, combined with the rate on the five-year asset is less than that which could be earned on a new comparable two-year asset, then the rate locked in over the final two years will not be satisfactory. This is a basis risk with respect to three-year forward two-year rates. While there is basis risk in this procedure, the more serious risk of changes in the general level of three-year forward two-year rates has been eliminated.

Swaps can also be applied to overcome undesirable features of liabilities. Suppose a client wants a seven-year GIC, but only five-year assets are available. A seven-year swap to receive fixed and pay floating combined with a five-year swap to pay fixed and receive floating effectively converts the final two years into a floating rate liability, thereby eliminating the interest rate risk arising from the term mismatch. Swaps could also be used to handle the situation where the liability term was shorter than the assets.

The spread locked in for the first five years would need to be satisfactory. Also, there is basis risk with respect to the five-year forward two-year rate.

6.7 Interest Rate Swaps and Portfolio Management

If it is anticipated that rates will increase, a portfolio manager may sell bonds and hold cash or shorter term bonds. However, these bond sales may not be desirable. There may be adverse tax or financial statement consequences. There may be a substantial market or transaction cost due to the size of the trades or the illiquidity of the bonds. The bonds sold may be desirable for portfolio reasons such as diversification or they may be part of a bond strategy. It may be anticipated that quality spreads will narrow at the same time rates increase. Continued ownership of the bonds permits participation in gains from a narrowing in quality spreads.

An interest rate swap to pay fixed and receive floating can reduce the portfolio exposure to an increase in rates without disrupting the bond portfolio. If rates do rise, as anticipated, an offsetting swap can be entered into. The unrealized capital loss attaching to the bonds from the rise in rates is offset by the positive spread earned on the two swaps.

An interest rate swap to receive fixed and pay floating can increase the portfolio's exposure to a drop in rates. The bond manager need not sell short-term bonds and replace them with longer term bonds. If a widening of quality spreads is anticipated, the bond manager can continue to hold cash and avoid participating in losses from the widening.

CHAPTER 7 – FUTURES, FORWARDS AND REPURCHASE AGREEMENTS

7.1 Futures and Forwards

A futures contract is an exchange – traded, highly standardized contract obliging a buyer and a seller to trade at a set price on a future date or during a specified delivery period, a fixed amount of a specified commodity, currency, specific financial asset or index. The future is a price-fixing contract because the buyer takes on the financial consequences of owning the asset as soon as the future contract is established. The futures price quoted is the price to be paid at maturity in exchange for the asset.

A futures exchange is a central marketplace where futures contracts are bought and sold competitively and openly. All contract terms and conditions are specified by the exchange except the price. The exchange establishes and enforces trading rules and collects and publishes market information.

The standard terms and conditions of a futures contract make it more liquid and easy to trade. Contracts of the same maturity are identical and consequently can be traded anonymously. A centralized clearing house records, registers and administers all contracts until they are closed out or until delivery. The clearing house guarantees each contract, eliminating the individual management of credit lines and counterparty risk.

A buyer of a futures contract, who holds it until expiry, is obligated to accept delivery of the underlying asset or index. The seller is committed to make delivery during the delivery period.

Most futures contracts are settled in cash by closing out the contract prior to the commencement of the delivery period, rather than through the exchange of the future price for the underlying commodity, currency, market index or asset. In the case of futures on indexes, cash settlement will be the only means of settlement. To close out their “open positions,” buyers simply sell their contracts and sellers simply buy offsetting contracts. The purpose of futures contracts is generally to capture the change in market value of the underlying asset or index and not to secure delivery of the underlying asset or index.

At the time the futures position is established, the investor is required by the exchange to put up collateral or margin equal to a small, specified percentage of the contract’s face amount. This margin is a good faith deposit and not a down payment. The exchange defines the amount of this “initial margin.” Every day thereafter, the investor will either pay or receive a “variation margin” equal to the change in price of the underlying asset or index times the face amount of the contract. This daily settlement means that the difference between the price of the underlying asset at contract initiation and maturity will be paid over the life of the contract. Variation margin payments should be recognized as accounting gains or losses in a fashion consistent with the related investment.

The clearing house is responsible for the collection of margin deposits and the settlement of gains and losses. The clearing house acts as the buyer to every seller and the seller to every buyer. It guarantees payment on every transaction in the event of a default by one of the parties to the futures contract. The margin provides the clearing house with the financial resources to provide the guarantee along with the capital and support provided by the exchange members. In this way, the financial integrity of the clearing house is ensured. The clearing house also assigns deliveries.

A futures contract is an off-balance-sheet item. Consequently, the value of the financial instrument underlying a futures contract is not reported on the balance sheet in financial statements. Initial margin continues to be owned by the company and should be shown as a company asset. The securities underlying futures margin receipts provided to the clearing house (Trans Canada Options Inc. – TCO) will also be shown as company assets.

The theoretical strike price of a bond future equals the current price of the bond plus the cost of financing its purchase until the delivery date less the yield earned on the bond. Bond futures normally have a strike price lower than the current spot price because the short-term borrowing cost is normally less than the bond yield. Supply/demand expectations can cause the strike price of a commodity future to be less than the current spot price even though there is no earned income to help reduce the financing costs.

Forwards

A forward contract is an over-the-counter future. The contracts are more flexible than future contracts. The price quote on a forward is the forward price that is payable at maturity in exchange for the asset. A forward contract is executed over the phone. Subsequently, written confirmations and signed contracts are exchanged.

Normally, there is no margin. Cash changes hands only at maturity, when the buyer pays the forward price and receives the asset, or cash settlement of the difference between the asset and forward price takes place. Consequently, both parties have credit exposure to each other for the term of the contract. To reduce credit risk, collateral may need to be posted at the outset or when an adverse market move exceeds a predetermined threshold. A forward contract on a share usually has physical settlement.

One of the most common types of forward contracts is a forward rate agreement (FRA). Unlike a future, there is usually no initial or variation margin. The parties to the FRA contract agree to exchange the difference between the market rate on an index, such as three-month LIBOR, on the contract settlement date, which is six months from the start date, say, and a fixed rate agreed to on the purchase date of the FRA. The purchaser benefits from rate increases and the seller benefits from rate decreases. FRAs are referred to in terms of the number of months to the beginning and end of the FRA. A six-month FRA starting two months forward is a 2 X 6 FRA. An interest rate swap is a package of FRAs, one for each floating rate reset date.

The most common forward contract is the forward currency agreement (FCA). Currencies are bought and sold up to one year forward on a regular basis. Major currencies can usually be brought forward for at least five years without difficulty. Usually no money changes hands prior to maturity. The FCA fixes an exchange rate for exchanging currencies on the settlement date. Settlement may be by an actual exchange of physical currency, but usually involves a cash payment equal to the value of the difference between the exchange rate fixed by the contract and the spot exchange rate at the time of settlement.

The Ten-Year Bond Future

The ten-year Government of Canada bond futures contract (CGB) traded on the Montréal Exchange is an example of a futures contract. The trading unit is $100,000 of a notional Canada bond with a 9% coupon. Any Canada bond can be used in delivery with 6 1/2 to 10 years maturity as of the first day of the delivery month and a minimum of $3.5 billion outstanding as determined by The Montréal Exchange. The delivery day is any business day in the delivery month (seller's choice). Delivery should be settled through the Canadian Depository for Securities (CDS) on the fifth business day following tender of the delivery notice. The last trading day is the seventh business day preceding the last business day of the delivery month. The future is quoted per 100 of value in increments of .01. Delivery notices must be submitted on the fifth business day preceding the last business day of the delivery month. Minimum margin requirements per contract are $3,000 for speculators, $1,000 for hedgers and $300 for spreads. Positions are limited to 4,000 contracts unless prior approval is received from The Montréal Exchange (hedgers only).

The Conversion Factor

Sellers may deliver Canada bonds that do not have a 9% coupon and that vary as to maturity. The price amount for any delivery bond is calculated using a conversion factor. The purpose of the conversion factor is to bring all the deliverable bonds on to a common basis for delivery.

The conversion factor is the price at which the delivered bond with $1 par value with the same maturity and coupon would be sold to yield 9% on the first day of the delivery month (less accrued interest). A list of conversion factors are published by the Montréal Exchange before the contract is listed for trading.

The delivery settlement amount is the accrued interest plus the futures settlement price times the conversion factor times 1,000. The seller has the choice to select which bond to deliver. There will be one bond that maximizes the seller's gain or minimizes the seller's loss. This bond is referred to as the "cheapest-to-deliver" bond. The issue with the narrowest "basis" is the "cheapest-to-deliver" bond. The basis is the cash bond price – the futures price times the conversion factor.

The Toronto 35 Index Future

In 1987, the Toronto Stock Exchange developed the Toronto 35 index. The index consists of 35 liquid Canadian stocks representing most of the TSE 300 industry groups except real estate and construction. The index is highly correlated with the TSE 300 and is calculated every 15 seconds.

The selected stocks are large market capitalization, publicly listed, and heavily traded stocks. Many are interlisted on other international stock exchanges.

The Toronto 35 index futures contract (TXF) is valued at $500 times the Toronto 35 index futures price. Price increments are .02 or $10 per contract. There are position limits for speculators and hedgers and reportable positions. Contracts are available for the three consecutive near months. There are daily price limits and minimum client margins. Trading terminates at 4:15 p.m. on the Thursday before the third Friday of the contract month.

Open positions at the termination of trading are marked-to-market based on the official opening level of the Toronto 35 index on the following day. The opening level is calculated by the Exchange only when all 35 stocks in the index have opened for trading (board lots only). If the stock does not trade on that day, then the last trade price from the preceding day is used.

Actual delivery of the shares in the index never takes place. Settlement is always in cash. The cash settlement price is $500 times this official level. Settlement is on the second business day following the last trading day.

7.2 Hedging and Risk Management Uses of Futures

Futures can be used for hedging, portfolio or risk management and for leveraged speculation on prices or interest rates. A future can be sold to hedge excess assets or bought to hedge excess liabilities or to gain market exposure until an outstanding premium is received or excess cash can be invested.

Futures on bonds or money market instruments can be bought and sold to increase or decrease portfolio duration. The shift in duration may be to reduce a duration gap between assets and liabilities or it may be to achieve a shift consistent with the portfolio manager's views on interest rates.

Futures can be used in asset overlay strategies. Futures provide a fast efficient way for portfolio managers to implement investment strategies without impacting their portfolio. They can be used to rebalance relatively illiquid portfolios.

Bond Hedging Strategy

Assume $10 million par of excess Canada bonds are held. These bonds meet the delivery requirements for the CGB contract and The Montréal Exchange has established a 1.04 conversion factor for the bond. This means that $100,000 par of the Canada bonds can be delivered to meet $104,000 of contract requirement.

The insurance company would sell

$$\frac{10{,}000{,}000}{100{,}000} \times 1.04 = 104 \text{ contracts}$$

However the contract value changes, the $10 million par of excess Canada bonds can be used to deliver on the contract. The bonds are hedged.

Equity Hedging Strategy

Assume a pension fund portfolio manager has a $10 million Canadian equity portfolio with a beta relative to the TSE 35 of 1.1. She feels that the portfolio is particularly vulnerable at present market levels. The portfolio manager can approximately hedge this position by selling $11 million of TXF contracts.

Foreign Exposure

Registered pension plans in Canada are restricted to a maximum of 20% in non-Canadian stocks or bonds by Revenue Canada without suffering severe tax penalties. This restriction exists in cash markets. Revenue Canada treats non-Canadian futures contracts as “having no value” and, as such, futures contracts will not affect foreign content restrictions (with the exception of any foreign currency margins). As a result, some pension plans make use of the roughly 13 foreign exchanges that offer stock and bond futures to increase their foreign content above the 20% level.

Asset Overlay Strategy

The asset mix of a $1 billion portfolio is 20% stock, 60% bonds and 20% mortgages. It is desired to increase (decrease) the equity exposure to 25% (15%) and to decrease (increase) the bond exposure to 55% (65%) without disturbing the existing portfolios. In the cash market, $50 million of stocks would be purchased (sold) and $50 million of bonds sold (purchased). The overlay strategy would leave the portfolio intact but purchase (sell) $50 million of stock index futures and sell (buy) $50 million of bond (stock index) futures. TSE 35 index futures (TXF) and ten-year Government of Canada bond futures (CGB) could be used. The market exposure requirements are now met.

The asset overlay strategy might be preferred to a cash market transaction because it leaves a desirable portfolio intact, it defers the realization of gains and losses for reporting and tax purposes, it reduces the commissions payable (futures commissions are lower than cash market conditions) and it can be easily and rapidly implemented.

Fixed Income Portfolio Duration Adjustment

Suppose the liability duration is seven years and the asset duration is 6.5 years. The market value of both assets and liabilities is $1 billion. The portfolio manager is concerned about an interest rate drop and wishes to completely close the duration gap. The manager decides to use futures with a duration of six years and price of 105 to close the gap. The number of futures contracts to purchase can be calculated as

$$\#\ \text{Contracts} = \frac{\text{Required duration change}}{\text{Duration of the future}} \times \text{Market value of the portfolio} \times \frac{1}{\text{Market value of the future contract}}$$

$$= \frac{.5}{6} \times \frac{1{,}000{,}000{,}000}{105{,}000} = 794 \text{ contracts}$$

The formula is obtained by equating the dollar duration impact required to the dollar duration impact of the contracts. The increase in value from a 1% uniform drop in rates on the 794 futures contracts when added to the increase in value on the $1 billion of assets should approximately equal the increase of the liability.

A Synthetic Asset Strategy

One strategy combines T-bills and a futures contract to create a return equivalent to the underlying Canada bond. The total return on the purchase of one contract ($100,000) could be calculated as follows:

Initial Investment	
Initial margin	$3,000
T-Bills	$97,000
	$100,000
Investment Income	
Interest on initial margin	$150
Interest on T-Bills	$3,850
Variance account	$1,000
	$5,000

Total return over period = 5%

Hedging Using BA Futures Contracts

If an insurer owned three-month bankers acceptances (BAs) and wished to fix the return earned on the BAs over a six-month horizon, it could purchase three-month BA futures contracts maturing in three months. The insurer would have fixed the rate earned on its BA position for six months, effectively extending the term of its BAs from three to six months.

When the yield curve is positively (negatively) sloped, a discount (premium) is factored into the price of the futures contract. For example, assume three-month T-Bill rates are 6% and 10-year Canada bond rates are 8%. Instead of buying the ten-year Canada bond future, the insurer could borrow for three months and buy a ten-year Canada bond. The insurer will earn the difference between the 6%, three-month rate and the 8%, ten-year rate. This “positive cost of carry” results in a discount on the futures price. If this discount is not reflected in the futures price, arbitrageurs will bid the futures price down until the discount is reflected.

Hedging Future Debt Issues

Futures may be sold to hedge future debt issues against rises in interest rates. If rates rise, the sold futures contracts will result in gains that offset the extra debt cost from the higher rates. If rates drop, a loss will be incurred that represents an opportunity cost (i.e., the opportunity to benefit from issuing debt at lower rates is sacrificed).

Hedging an Outstanding Premium

Futures may be bought to hedge future premium from a liability that has been priced. If rates drop prior to the receipt of the premium, the gains on the future position will offset the lower rate earned on the investments purchased when the premium is received. If rates increase, a loss will be incurred that represents an opportunity cost (i.e., the opportunity to benefit from investing the premium in a higher interest rate environment than assumed in the price is effectively sacrificed).

Arbitrage and Speculation

Arbitrageurs attempt to make money by taking advantage of differences between cash and future market prices. Speculators and arbitrageurs contribute materially to market liquidity by buying and selling large volumes of futures contracts.

7.3 Risks Associated With Future Contracts

The risk of owning (being "long") a future is the same as owning the underlying asset or index. The maximum potential loss equals the strike price and arises when the underlying asset or index has lost all its value. If the long future position is established as a hedge or as an alternative to a cash market transaction, this risk is no different from the risk of establishing the equivalent cash market position.

The loss at expiry, if any, from selling (being "short") a future equals the difference between the value of the underlying asset or index and the strike price. There is no maximum potential loss, since the value of the underlying asset or index can increase without limit. If the short future position is established as a hedge, this risk is an opportunity cost (i.e., the potential gain that would have been realized as a result of in prices).

When futures are not used to hedge or as an alternative to a prudent portfolio cash market transaction, the risks of futures are substantial. By depositing a small initial margin, the future can cause the investor to receive or pay several times that amount in daily variation margins. It is this leveraging or speculative use of futures that is of great concern to regulators, boards, and senior management of financial institutions.

When used in hedging strategies, there may be considerable basis or timing risk between the hedged position and the hedging future.

Futures are not available on all types of commodities, currencies securities, and market indices. Even when the required type of security etc. is available, it may not be available on the precise instrument required for a perfect hedge. A ten-year Canada bond future may be shorted to "hedge" a 12-year mortgage or corporate bond. A future on a stock index may be shorted to "hedge" a specific stock portfolio. In the absence of a perfect hedge, the futures position is subject to basis risk. Basis risk arises when there is not a perfect correlation between the change in value between the hedged position and the hedging future.

Even when the precise future required is available, differences in the cash and future market prices can arise as a result of supply and demand factors and a shift in the cash market yield curve. The price differential is called "the basis." Changes in "the basis" can be significant, and, at times, the cash and futures price can move in opposite directions. This risk can be reduced by structuring hedges to terminate in the delivery month of the futures contract. This reduces basis risk since the cash and futures prices will converge during the delivery month.

Many corporate end users, pension funds and mutual funds relied on the exchange rate mechanism to support a kind of "speculation" on currency correlations. Instead of hedging high EMS interest rate currency exposures, such as Italian lire, Spanish pesetas or Portuguese escudos with their own

currencies, they "hedged" them with low interest rate currencies such as Deutschmarks or Swiss francs. They bet that the close correlation between these currencies that persisted for the period from 1985–1990 would continue. Such action substituted straight currency risk for currency correlation risk. For many, this "hedging" strategy actually increased risk and resulted in material losses when the mechanism that had preserved this artificial linkage between currencies finally broke down.

Timing risk arises when the hedging future does not expire at exactly the same time as the expiry of the risk being hedged. If the future expires late, the future may need to be unwound early at a value considerably less than the value needed to hedge a loss. If the future expires early, the hedge may need to be rolled over one or more times. Timing risk is especially acute if the futures are being used to hedge nonmarketable obligations with a deferred delivery date such as oil delivery contracts.

The daily fluctuations in the value of short-dated futures can vary considerably from the fluctuation in the value of long-dated futures. Short-dated futures should be viewed with considerable scepticism as substitutes for long-dated futures that may or may not be available. Timing risk was a factor in the Metallgesellshaft future "hedging" losses of $1.4 billion, where "backwardation" was relied upon to justify buying short-dated futures to "hedge" very long-dated fixed price oil contracts.

Normally, futures prices on non-income earning assets exceed spot prices for the underlying asset or index as a result of the costs of holding the underlying asset or index. However, current supply shortages can cause short-term commodity prices to exceed the long-term price. The situation in which the forward curve is negatively sloped is called backwardation. Backwardation had prevailed for a number of years in the oil market prior to the fall of 1993, when short-term oil prices fell about $5 a barrel, while long-term prices did not change. Reliance on backwardation and this sharp fall in price produced the major losses at Metallgesellshaft.

Even though perfectly hedged, an insurer will not be indifferent to interest rate movements if they result in margin calls to cover contract losses or receipts of cash from contract gains. Adjustments to the number of contracts in the hedging position may be necessary to reflect the change in the cash position.

7.4 Repurchase Agreements and Security Lending

The repo (repurchase agreement) market is sometimes called the "financing" market, because it began as the market used by security dealers to finance their bond positions. While dealers still use it for this purpose, many financial institutions use it as a low-risk method of enhancing yields. To make markets in equities, bonds and derivatives, dealers must be able to sell securities short. To do this, they must be able to borrow securities. Reverse repurchase agreements can be used to meet this need. Central banks use the repo market for short-term monetary control.

Consider an arrangement in which the holder of a security sells the security at market for cash to a counterparty with a simultaneous agreement to repurchase the securities at a fixed price (inclusive of interest) on a fixed date. Although a sale takes place, the seller retains the full market exposure to the security, since the seller must pay a fixed price for the security at a future date, whether the security increases or decreases in value.

The transaction is a repurchase agreement from the perspective of the counterparty selling the security for cash and a reverse repurchase agreement from the perspective of the counterparty paying cash for buying the security.

Repoed securities are usually not taken off the seller's balance sheet. A debt is booked to the buyer for the full amount of the repoed security. Repoed securities are usually not included in the buyer's balance sheet. A receivable is booked to the seller for the full amount of the repoed security.

The securities dealer, hedge fund or financial institution needing to finance a government bond position sells the bonds to a cash investor, while simultaneously agreeing to repurchase them at a later date. The seller is effectively borrowing cash and using the bonds as collateral. The purchaser of the security (cash investor) is effectively lending money to the seller on a fully secured basis and earning a return equal to the difference in cash paid to, and received from, the seller. This return is known as the repo rate.

The yield on repos is highly competitive with bank deposits, even though investment theory might suggest repos should provide a materially lower yield to reflect their fully secured nature. However, many participants in the repo market, such as securities dealers, are not members of central banking systems such as the Federal Reserve and so cannot enter the wholesale deposit market available to banks. Because dealer sources of financing are more limited, repo rates can even exceed deposit rates when dealers are competing for limited financing.

The minimum investment is usually $1 million. The U.S. Treasury repo market has thrived since the 1960's and has more (over half of the worldwide) daily turnover (in excess of $1 trillion) than any other financial market. It is regarded as a safe, flexible alternative to deposits, money market instruments and commercial paper.

Repos may be done for a specific term for any term from one day up to a year. This maturity flexibility is an attractive feature, since it enables the cash investor to tailor the arrangement to meet cash needs. Alternatively, they can be done on an open basis, where the repo is in place until one of the parties terminates it.

If the cash investor takes delivery of the bond into one of its accounts, settlement instructions will be needed and custody and transfer charges will be incurred. The most common arrangement is a "hold-in-custody" repo transaction, where the bonds are placed in a safekeeping account in a clearing bank, Euroclear or Cedel. In a tri-party repo transaction, a custodian bank or clearing house takes delivery of the securities on the investor's behalf and ensures that both parties fulfil their responsibilities. The dealer assumes all the custody and administrative costs.

To the extent that repos are not supported by a legally enforceable contract and a margin account, there is a risk that the counterparty will renege on the second leg of the arrangement. In 1990, Germany's DG bank tried to renege on agreements to repurchase Dm 6 billion of bonds that it had sold to at least eight French banks.

If the assets sold are held in custody by the seller in the repo arrangement (rather than by the purchaser or a third party), there is the risk of outright fraud. On March 23, 1994, Wallace Smith, a British merchant banker, was imprisoned for six months, for just such fraudulent activity in relation to repos worth 100 million pounds in relation to the Wallace Smith Trust Co.

It is possible to use reverse repurchase agreements to leverage asset duration beyond that available in the cash markets. Assume $100 million of 30-year Canada bonds are sold under a reverse repurchase agreement with a dealer. The seller retains the interest rate exposure to the $100 million of 30-year Canada bonds. The seller receives cash that it can use to purchase a further $100 million of 30-year Canada bonds. Even though the seller only owns $100 million of Canada bonds, the reverse repurchase agreement means the seller owns $200 million of interest rate risk exposure. In this way, it is possible to use reverse repurchase agreements to duration match very long duration liabilities. It is also possible to leverage the fund as with Orange County and many hedge funds in order to place speculative bets on interest rate movements.

Security lending is an alternative to reverse repurchase agreements. Institutions that own the securities being sold short lend them to the dealers against collateral, for a fee. Through security lending, institutions can earn incremental return. The size of the incremental return depends on the demand for the security, the supply of the security and the range and flexibility of permitted investments for the collateral account.

Security lending is usually thought to be a low risk activity. However, the discussion in Sections 2.1 and 2.1.1 of security lending losses absorbed by Harris Trust, Mellon Bank and Boatman National Bank indicate that market risk can lead to sizeable losses on cash collateral accounts, even without a borrower failure or a credit loss on collateral.

Usually, the securities lent are not taken off the lender's balance sheet. The securities are considered to be the borrower's property and are recorded on the borrower's balance sheet at market. A debt is recorded to the lender for the market value.

CHAPTER 8 – OPTIONS, FORWARD SWAPS, SWAPTIONS, CAPS, FLOORS, COLLARS

8.1 Options

An option is a contract in which the buyer pays a fee (called a premium) in exchange for the right, but not the obligation, to buy (a call option) or sell (a put option) a fixed amount of a specific commodity, currency, swap, futures contract, financial asset or market index at a set (strike) price within, or at, a specified time.

Dividends on individual stocks and coupon payments on individual bonds that are received during the option term are not usually paid or due to the call option owner. The option is on the underlying asset or index itself. The call (put) option price will be higher (lower), in the event that such payments are to be paid. In the case of options on total return indexes, these payments will be taken into account indirectly.

An option may be exchange-traded, with standard terms, or over-the-counter, with terms negotiated directly between the two parties. The amount that can be purchased/sold is the "face amount" of the contract. The premium paid is usually a small fraction of the face amount.

Stock option contracts and the rules of option exchanges usually immunize counterparties against stock splits, stock dividends, rights issues and other similar actions.

Exchange-traded option prices are quoted in cash terms. If the price of an over-the-counter option is expressed as a percentage, the end user needs to be clear as to whether the percentage applies to the strike price or the underlying asset value (if they differ). Prices quoted in percentage terms are not very sensitive to changes in the price of the underlying asset or index and may continue to apply, even if the market has moved.

Call options are not securitized, so they can be sold without the seller owning the underlying asset or index. This distinguishes a call from a warrant, which is a securitized call that can only be sold, if the seller owns the actual security. The warrant, being a physical security, must be physically settled.

Options terminate through their exercise, expiration or through an offsetting option purchase or sale (closing transaction). Options settle upon exercise through delivery of the underlying asset or index or through cash settlement of the difference between the strike price and the asset value. Options on indices almost always specify cash settlement. Options on single stocks usually have physical settlement.

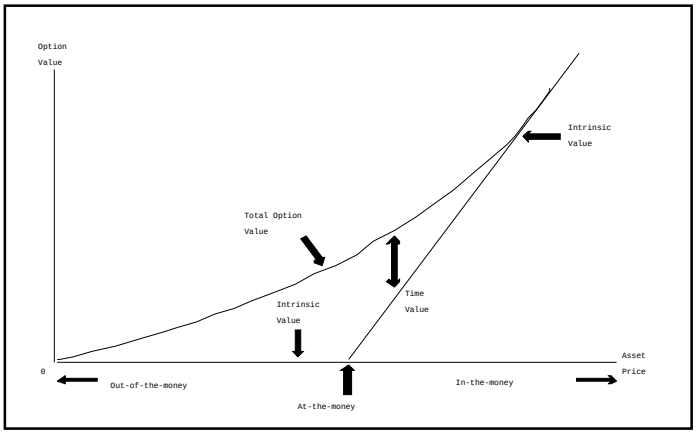
A European-style option is one which may be exercised only on the expiration date. An American-style option is one which can be exercised at the owner's choice, any time prior to expiration. "Transatlantic" or Bermudan-style options can be exercised before maturity, but only at specific times on specific dates (once a week, or once a month, etc.). An option is path-dependent if its value depends on the value of the underlying asset or index at more than one time. A European option is not path-dependent, whereas American and Transatlantic options are.

The risk of loss from an option depends on whether you are purchasing or selling, and, if selling, whether you are "covered" or "naked." The buyers of options cannot lose more than their option premium. A written call (put) option is "covered" if the writer owns the underlying asset or index or an offsetting call (holds cash or an offsetting put) in an amount equal to the amount of the option written. The cost of covered call writing is one of opportunity. A written option is "naked" if it is not covered. The potential loss on a naked call is unlimited and on a naked put is 100% of the strike price.

A call or put option is said to be at-the-money, if the strike price equals the current value of the underlying asset or index. A call (put) is said to be in-the-money, if the strike price is less (greater) than the current value of the underlying asset or index. A call (put) is said to be out-of-the-money, if the strike price is greater (less) than the current value of the underlying asset or index. A call (put) is said to be deep-in-the-money or deep-out-of-the-money, if it is in or out-of-the-money, respectively, and the difference in strike price and the current value of the underlying asset or index is viewed as being large. If an out-of-the-money option is purchased to partially hedge a position, the hedger can lose an amount equal to the premium plus the difference between the current and strike price.

Put-call parity refers to the notion that the European put option premium should equal the European call premium (for a call with the same strike price and expiry date) plus a short position in the underlying plus the present value of a riskless investment that will accumulate at the risk-free rate at option expiry to an amount equal to the strike price.

The intrinsic value of an option is the difference between the current price of the underlying asset or index and the option strike price for in-the-money options, and zero for other options.



The solid line is the intrinsic value and the dashed line is the total option value (premium) at some time prior to option expiry. The difference is by definition the time value. While time value clearly increases with time to option expiration, it also increases with price volatility and the cost of carry. The time value is greatest when the option is at-the-money and decreases as the difference between the strike price and the current asset price increases.

8.2 Option Premiums and Pricing

If the probability distribution for the price of the underlying is known at option expiration, the value of a European option can be calculated as the sum of the present value of the probability weighted option values at expiry based on this distribution. The distribution is often taken to be lognormal with mean equal to the current forward price to prevent risk free arbitrage. The option premium can thus be seen to depend on the time to expiry (which impacts both the breadth of the distribution and the impact of present valuing), the price volatility of the underlying asset (which impacts the breadth of the distribution), the strike price (which impacts the option value at expiry at any point on the distribution), the current forward price for the underlying (which impacts the mean of the distribution) and current interest rates (which are used in taking the present value).

A broader distribution and consequent higher premium arises the longer the time to option expiry and the greater the price volatility of the underlying asset. The option tends to lose value as time passes because the distribution of outcomes at option expiry narrows with the passage of time.

More precisely, call (put) option premiums increase (decrease), the higher the current stock or bond price, the lower the strike price, the higher current interest rates and the lower the expected dividends or interest payments. Call and put premiums both increase, the higher the expected volatility and the higher the face amount. American and Transatlantic call option premiums are equal to, or greater than, European call option premiums. American and Transatlantic put option premiums are greater than European.

Call option premiums increase the longer to maturity. However, put option premiums may or may not increase the longer to maturity. Increases in time to maturity decrease the present value of the strike price and hence the value of the put option. However, increases in time to maturity increase the likelihood of profitable exercise of the put option. The net impact of these factors may increase or decrease the put option value.

Analytical or closed-form option pricing models find an explicit solution for the option price using mathematical equations. Many of these, like the Black-Scholes model, specify and solve a stochastic differential equation. These models cannot be used to price American-style options whose value depends on the price of the underlying security throughout the period prior to option expiration, since the security price cannot be expressed as a single parameter. The models cannot easily handle variations in the risk-free rate or volatility and so are increasingly less accurate the longer the option period.

Numerical techniques are sometimes used to estimate the premium for early exercise of an option. This numerical estimate is then added to the European option price obtained using a closed-form option pricing model in order to estimate the premium for an American-style option. The Barone-Adesi-Whaley model, for example, uses a quadratic approximation approach to accurately value American-style puts and calls on assets paying continuous dividends.

An arbitrage-free option pricing model is based on the assumption that arbitrage of the underlying variable is not possible. The Cox-Ingersoll-Ross, Ho-Lee, Heath-Jarrow-Morton and Hull-White interest rate models are arbitrage-free. Constraints are placed on interest rate changes to prevent arbitrage.

The Black-Scholes option pricing model was developed in 1973 and remains the industry standard for pricing European stock options. It provides an arbitrage-free value for European style options on stocks as a function of the share price, the exercise price of the option, the risk-free interest rate, the time to option expiry and the variance of this stock price. It assumes no dividends, no taxes, no transaction costs, a constant risk-free rate and a constant stock price volatility. It also assumes that the stock price is log normally distributed, that the market operates continuously, that the stock price changes continuously from one time to another, and that no penalties apply to short sales. The assumption of constant stock price volatility causes the Black-Scholes model to undervalue near-maturity options, deeply out-of-the-money options and options on low volatility stocks and to over value long-term options, deeply-in-the-money options and options on high volatility stocks.

The Black-Scholes model describes how a risk-free portfolio can be constructed, which contains the option, a position and an offsetting “mirror” position consisting of the underlying stock and a money market position. The riskless position can be maintained by continuously buying or selling the underlying stock in the correct amount. On the no-arbitrage assumption, this riskless position must earn the risk-free rate of return. Consequently, the value of the portfolio at any time is its value at expiry discounted back at the risk-free rate. The price of the option can then be determined from the price of the underlying based on the lognormal assumption about stock price.

The Black’s model extends the Black-Scholes model to valuing interest rate options. The model assumes the probability distribution of future interest rates is lognormal with a mean equal to the

forward interest rate and a standard deviation equal to an observed volatility that depends on both the time to option expiry and the term of the rate. This model is used to value caps, floors, European bond options and swaptions. It cannot be used to value path-dependent options.

The Garman-Kohlhagen pricing model extends the Black-Scholes option pricing methodology to pricing currency options with modifications to allow for two interest rates and the fact that a currency may trade at a forward premium or discount.

The Cox-Ingersoll-Ross option pricing model generalizes the Black-Scholes model by modelling expected returns from changes in the term structure of interest rates. The Ho-Lee, Heath-Jarrow-Morton, Black-Derman-Toy and Hull-White models model volatilities at different points in the term structure to derive a probability distribution for an arbitrage-free lattice of the term structure. For example, the Hull-White model uses the observed volatility of the short-term rate "*a*" and an observed reversion rate "*b*" to reflect that long rates are less volatile than short rates. These models allow the whole-term structure to be stochastic and not just the single price of an underlying asset or interest rate. This allows long- and short-term interest rate options to be priced consistently.

The Ho-Lee model assumes the returns on zero-coupon bonds at different terms are perfectly correlated. The Heath-Jarrow-Morton model is a two-factor term structure model that does not make this assumption. The term structure and its volatility through time are inputs.

A binomial option pricing model uses a binomial tree or lattice to price the underlying. It thus uses an algorithm instead of a closed form formula. Binomial trees are particularly useful in valuing American-style and interest rate options. The time to option expiry is divided into a series of discrete time intervals. The price or yield is assumed to move up by a proportion *u* of the value at the beginning of the interval with probability *p* or down by a proportion *d* with a probability 1-*p* at each interval. The values of *u, d* and *p* are based on the assumption of a normal distribution. By working backwards through the intervals from the option expiry date, when the option value is known, to the present, the arbitrage-free value of the option can be calculated. The Cox-Ross-Rubenstein model is the best-known.

If a move up followed by a move down results in the same price as a move down followed by a move up, the branches of the tree recombine and the process is path-independent. A tree in which branches do not recombine are "exploded" trees. They are computer intensive since the number of branches increases exponentially. However, they can be used to price path-dependent options. Trinomial and multinominal models allow three or multiple movements.

8.3 Option Uses and Strategies

To hedge a position against losses from an increase (decrease) in rates, a put (call) option on a bond of appropriate term would be purchased. The put (call) option increases in value with increases in rates above (below) the rate equivalent to the strike price on the option. These option gains hedge the losses on the position hedged.

To hedge a stock portfolio that is highly correlated with the TSE 300 against a decline in value, put options could be bought on the TSE 300 index. Should the index decline in value below the put strike price, the put option will increase proportionately in value. Assuming the amount of puts purchased bought protection for the entire portfolio and that the portfolio loses value to no greater extent than the index, the gains on the puts will offset the losses on the portfolio.

Options used for hedging can be expensive. To reduce the cost, the strike price of a call (put) can be increased (decreased). While reducing the cost, this also means a greater loss must be absorbed before the protection of the option kicks in.

To reduce the cost of hedging, the purchaser of a call (put) can write an otherwise identical option with a strike price that is higher (lower) than the strike price of the purchased option. This is referred to as an option spread. While the cost of the "hedge" is reduced, the potential benefits from the "hedge" is restricted to the difference between the two strike prices. The losses on the hedged position arising from increases (decreases) in rates above (below) the rate equivalent to the strike price on the put (call) that has been sold must be born by the "hedger." The draft NAIC Model Investment Law does not allow use of option spreads.

The cost of purchasing a call (put) can be reduced by simultaneously writing a put (call) with a lower strike price. The combined option positions are referred to as a collar. The strategy can be prudent, if the balance sheet is exposed to losses from increasing (decreasing) rates and gains from decreasing (increasing) rates, say. The losses on the hedged position arising from increases (decreases) in rates are offset by gains on the purchased put (call). While relatively inexpensive protection is thus provided, this strategy gives up the opportunity to benefit from gains on the hedged position from decreases (increases) in rates. Any gains on the hedged position from decreases (increases) in rates will be offset by losses on the call (put) that has been sold.

Option spreads can be used to take positions rather than hedging. A bull call (put) spread is the simultaneous purchase and sale of call (put) options, with the same expiry date, where the purchased call (put) has a lower strike price than the sold call (put). The benefits from an increase in the value of the underlying asset or index are capped, but the loss is limited to the net premiums paid. A bear call (put) spread is like a bull call (put), except that the purchased option has a higher strike price than the one sold and the investor benefits from a decrease in the value of the underlying asset or index. Complex combinations of options, such as the combination of bull and bear spreads, are called butterfly spreads.

A long (short) straddle is the purchase (sale) of a put option and a call option on otherwise identical terms. A long (short) strangle is a long (short) straddle in which option strike prices are equally out-of-the-money.

A horizontal spread involves the simultaneous sale of an option with a nearby expiry date and the purchase of an option with a later expiry date, both of the same type and with the same exercise price. A vertical spread involves the simultaneous sale and purchase of options of the same type and expiry date, but a different strike price. A diagonal spread involves the simultaneous sale and purchase of options of the same type with different expiry dates and strike prices.

8.4 Delta, Gamma, Theta, Vega, Rho

Delta is the ratio of the price sensitivity of the option to small changes in the price of the underlying asset or index. It is the first partial derivative of the option price with respect to the price of the underlying. Delta lies between –1 and +1. The delta of a call option can be interpreted as the probability of the option expiring in the money. An option whose price changes by $1 for every $2 change in the price of the underlying asset or index has a delta of .5.

The value of a call increases with increasing value of the underlying asset or index and with the time to expiration. At very low values of the underlying asset or index (i.e., when the option is deep-out-of-the-money), delta approaches zero. At high option values (i.e., when the option is deep-in-the-money), delta approaches one.

Owning a deep-out-of-the-money call option provides almost no exposure to the underlying asset or index. Owning a deep-in-the-money call option is like owning the underlying asset or index. The transition from a delta of zero to a delta of one is more rapid the closer you are to option expiry.

The value of a put increases with decreases in value of the underlying asset or index and with time to expiration. At very low option values (i.e., when the put is deep-out-of-the money), delta approaches zero. At very high option values (i.e., when the put is deep-in-the-money), delta approaches minus one.

Owning a deep-out-of-the-money put provides almost no exposure to the underlying asset or index. Owning a deep-in-the-money put is like "shorting" the underlying asset or index, because the put increases (decreases) in value when the underlying asset or index decreases (increases) in value.

The risk exposure to an asset can be hedged by purchasing put options on the asset in proportion to one over the delta of the option. If one dollar of option changes in value by *c*, the asset will change in value by *c* times delta divided by delta (i.e., *c*). This approach is called delta hedging. A delta-neutral position exists when the combined financial position of options and underlying asset or index is unaffected by small changes in the price of the underlying asset or index. Delta hedging is strictly analogous to duration hedging in the context of interest rate risk management.

As time passes, a position that is initially delta hedged will not remain hedged, since the price of the underlying asset or index will change and this will produce changes in the price sensitivity of the option. The process of continuously adjusting the hedge to maintain delta-naturality is called dynamic hedging. This is analogous to the need to continuously adjust a duration neutral position through time.

Gamma (omega) is the second (third) derivative of the option premium with respect to the price of the underlying asset or index. Gamma measures the sensitivity of delta to small changes in the value of the underlying asset or index. The gamma of a call is greatest for an at-the-money call. The gamma of a put is identical to that of a call. In particular, it is greatest for an at-the-money put. Gamma increases as volatility decreases for an option which is at-the-money.

Gamma indicates how much of the underlying asset or index must be traded to keep a hedge on. A delta neutral position with a high gamma will need to be rebalanced frequently and the position is exposed to gamma risk (i.e., risk that shifts in the value of the underlying asset or index are not exactly offset by shifts in the value of the options). As an option approaches expiration, the gamma of an at-the-money option is quite high indicating that a lot of trading may be required to keep a hedge on.

Theta is the negative of the ratio of the change of an option price to a change in expiration date. The longer the time to expiration, the more likely it is that the option will expire in-the-money and so the more valuable the option will be. That portion of the option's value that results from this relation is referred to as its time value. Theta measures how fast the time value of the option vanishes.

Vega is the ratio of a change in an option price to a change in the volatility of the underlying asset or index security. It measures volatility risk. Volatility risk is greatest when the time to expiration is greatest. It declines as expiration approaches. Vega is always positive. At-the-money options are most sensitive to changes in volatility, while deep-in-the-money and deep-out-of-the-money options are insensitive. A change in the volatility assumption used to price an option will produce a change in option value even if there is no change in the value of the underlying asset or index. A position that is both delta and gamma hedged may thus still lose value.

Rho is the ratio of the change in an option price to a change in interest rates. Rho measures an option's interest rate risk. It is a kind of duration measure. In general, higher rates increase the value call options and decrease the value of put options.

8.5 The Forward Swap

The forward swap is just like the floating-fixed swap except that the exchange of payments does not commence until a future date. The fixed rate is based on rates prevailing at the time of transacting for the forward swap agreement. It can be used when there is potential for loss from a rise in rates, or when it is desired to move the realization of current bond gains or losses forward or backwards in time.

A corporation may have a future refinancing need due to a call date or maturity date on existing debt they have issued. A forward swap, commencing at this date, can lock in the current refinancing cost. If the debt is rolled over into floating debt, a forward swap to pay floating can lock in a fixed rate cost based on current rates. The forward swap can also lock in the cost of future borrowing in the case of real estate or project developments.

Since the fixed rate on the forward swap is based on current forward rates, the forward swap makes sense only when rates are expected to rise above the forward rates or there is a decision to hedge against such an outcome.

A forward swap can be used to hedge a liability in which the receipt of the premium is deferred. The commencement date of the swap would be the date of the receipt of the premium and the term of the swap would be the term of the liability. The liability writer would agree to receive a fixed rate. Upon receipt of the premium, fixed rate investments are made and the swap is unwound. If fixed rates have dropped prior to premium receipt, the fixed swap rate at premium receipt will be lower than the fixed rate on the forward swap. This positive spread, when added to the rate on the investment made at premium receipt, will support the liability rate, when combined with the lower rates received on the permanent assets in which the premium is invested.

If the rates have dropped since issue, the issuer of a callable bond can realize the gain now, by entering into a forward swap commencing at the call date to pay the fixed rate on the callable bond to its maturity. The forward swap counterparty will pay an amount up front reflecting the value of the excess of the callable bond rate over the regular forward swap rate. This allows the capture of the intrinsic value of the call option (i.e., the difference between the bond rate and the current level of rates). The time value of the call option must be forgone, however.

Forward swaps can be used to lock-in existing bond gains, while deferring the recognition of those gains for tax purposes. Forward swaps are written commencing at the desired disposal or maturity date of the bonds. If rates rise (fall) prior to this date, the bond value will decline (increase), but that of the forward swap will rise (decline).

Basis risk applies. For example, assume the spread over Canada bonds for the permanent assets narrows by 10 basis points, between the time the liability is sold (the price is set) and the premium is received and invested. If the spread over Canada bonds on the forward swap is the same as the spread on the offsetting swap (entered into at the time the premium is invested), the spread achieved will be 10 basis points less than was assumed in the pricing.

8.6 Swaptions

In a swaption, one of the counterparties has the right, but not the obligation, to enter into a forward swap on the exercise date. The option exercise date, the swap commencement date, the swap maturity date, the floating rate index, and the fixed rate are all determined in the swaption agreement at the outset.

The cost of the option feature can be paid up front, or at the exercise date, or it can be amortized over a period of time. The option can be American (i.e., exercisable at any time during the option period with the swap commencing immediately upon exercise or at the end of the option period). The

option can be European (i.e., exercisable only at the end of the option period), with the option normally commencing at that date. The option can be Transatlantic (i.e., exercisable a number of times during the option period, but only on predetermined dates).

The swaption is similar to a rate cap (see below). However, the swap market is more efficient at longer terms than the cap market. Consequently, the longer term swaption costs will normally be less than cap costs for the same maturity. Shorter dated caps, say of two years or less, are relatively cheap.

A callable (puttable) swap is one in which the fixed rate payer (receiver) has the right to terminate the swap at one or more predetermined dates or points on the swap curve. An extendible swap is one in which one counterparty has the right to extend the swap term. The call, put and extension right is equivalent to the purchase of a swaption.

In a reversible swap, one of the counterparties has the option to switch from being the floating to being the fixed payer or vice versa at a specified date. It is a combination of a swap and a swaption for twice the principal amount of the swap.

Suppose an insurer sells a GIC at a fixed rate to apply for one year upon the receipt of a known deposit amount in two months. Since no cash is received at the time of the sale, cash market hedging may not be feasible. A two-month forward on a one-year swap to receive fixed and pay floating could be used in hedging. Alternatively, a two-month option on the same one-year swap might be preferred, if one-year rates were expected to increase prior to the receipt of the premium. The swaption premium would be paid for the opportunity to participate in any increases in one-year rates. If increases occur, the option is left to expire unexercised.

A company interested in putting a ceiling on its fixed rate borrowing costs, but wishing to take advantage of any drop in rates, can use a swaption. In this way, the swaption premium buys insurance against an increase in interest rates. The firm arranges a floating rate banking facility in combination with a swaption to pay a fixed rate. The fixed rate puts a ceiling on borrowing costs as the option can be exercised if rates increase. If rates decrease, the option is not exercised and the firm can enjoy the lower borrowing costs.

Forward swaps enable the issuer of a callable bond to capture the intrinsic value of the bond call option. Swaptions enable the issuer to capture both the intrinsic and time value of the option, in effect, the issuer can sell the call option attached to a bond. The company sells a swaption to pay the bond coupon rate from the call date to the maturity date. The buying counterparty has the right, but not the obligation to exercise the swaption at the call date. It pays a premium that exceeds the corresponding premium on the similar forward swap, the excess representing the time value of the call option.

A cancellable swap is like a standard swap except that the purchaser has the right to exit the swap at one or more dates fixed in advance, without paying a cancellation penalty. A cancellable swap combines a standard swap with one or more swaptions.

8.7 Interest Rate Caps, Floors and Collars

Options can be bundled together to form option-based contracts called caps, floors and collars. Just as protection from losses from increasing (decreasing) rates can be purchased by buying a put (call) or put (call) spread, so it can be purchased by buying a cap (floor), a cap (floor) spread or a collar (long a cap, short a floor or long a floor and short a cap).

Just as there can be options and forwards on swaps, so there can be options and forwards on caps, floors and collars. Just as there can be amortizing and accreting swaps, so there can be amortizing and accreting caps, floors and collars, in which the notional principal amount decreases or increases according to a pre-set schedule or pre-defined formula.

A cap (floor) is like an option in that a premium is paid (usually in a single payment at purchase) and a "strike rate" specified. It is like a swap in that it is over-the-counter, involves a notional principal amount, periodic payments based on a reference rate, reset frequency, a term and a reference index rate. As with swaps, the notional amount is never exchanged, but is only used to calculate the payment amounts to be made.

If the index rate exceeds (is below) the strike rate on a reset date, the cap (floor) seller pays the purchaser an amount based on the product of the notional principal amount, the difference in the rates, and the fraction of year since the previous reset date. The final payment is made at the end of the term.

The notional amount and strike rate are usually fixed, but could vary by schedule or formula. The reference rate is often three-month BAs, LIBOR, prime or a government or swap constant maturity rate. The term can range from shorter than a year, to five or more years. The higher (lower) the cap (floor) strike rate, the less the premium. The reset frequency is usually monthly, quarterly or semi-annual. Payments are usually made at a reset date in arrears, based on the reference rate at the previous reset date. The premium can be paid at inception or over the term.

The cap (floor) is, in effect, a series of European put (call) options on the reference rate, with one option exercisable at the end of each reset period. A series of American options could be packaged, which would give the purchaser the right to exercise one option at any time during each reset period.

A cap (floor) can be created from any series of any different kind of option. A binary cap would be a series of binary put options (see Section 8.6), paying a fixed amount, if and only if the reference rate exceeded (fell below) the strike rate on any reset date.

A cap protects floating rate liabilities and fixed rate assets from a rise in rates. A floor protects floating rate assets and fixed rate liabilities from a drop in rates. Caps and floors thus provide "term stop-loss insurance" against a rise or fall in rates.

A minimum rate guarantee in an insurance product is a "floor" that the insurer has embedded in its insurance product. The assets supporting a product may be unable to fully support the minimum rate in some circumstances. A floor could be purchased, as deemed appropriate, to cover some or all of this risk. Conversely, assets supporting a product with highly competitive renewal rates may be unable to support a competitive rate should rates rise sharply. A cap could be purchased, as deemed appropriate, to provide the basis for a competitive rate.

Often caps and floors are expensive. Costs can be reduced by setting the cap (floor) rate sufficiently out-of-the-money. Costs can also be reduced by the purchaser of the cap (floor) writing an otherwise identical cap (floor) with a strike rate that is higher (lower) than the strike rate of the purchased cap (floor). This is referred to as a cap (floor) spread or corridor. While the cost is reduced, the potential benefits are restricted to the difference between the two strike rates. Losses on the hedged position from rate increases (decreases) below the strike price of the cap (put) that has been sold, must be borne by the hedger. The draft NAIC Model Investment Law does not allow use of cap (floor) spreads.

Costs can be reduced, in general with collars, which are equivalent to simultaneously buying a cap and selling a floor or vice versa on the same underlying asset or index for the same term, but different strike prices. A two-year collar on three-month BAs would involve buying a two-year cap and selling a two-year floor on three-month BAs. If the collar has a cap of 10% and a floor of 8%, the purchaser receives payments for rate increases above 10% and pays for rate declines below 8%.

Normally, no premium would be paid for the collar, since the seller of the collar normally specifies either the floor or the ceiling rate so that no net premium need be paid. The so-called “costless collar” may be quite “expensive” in implied volatility price terms, even though there is no dollar cost. The strike price on the cap and floor may imply a substantial volatility spread. If the buyer specifies the floor and ceiling rates, then a net premium equal to the premium on the ceiling being purchased reduced by the premium on the floor being sold would be paid.

Caps and collars are useful to borrowers wishing to lock in a maximum cost of funds. Floors are useful to investors wishing to fix a minimum rate for funds lent.

A collar (long a cap and short a floor, say) protects the hedged position from increases in rates, since the purchased cap increases in value with increases in rates. However, gains on the hedged position from decreases in rates must be foregone, since decreases in rates increase the amount that must be paid on the floor that has been sold.

Interest rate collars thus reduce the volatility of gains and losses arising from volatile interest rates. They can be useful in periods when interest rates are expected to be more volatile than normal due to political, monetary or fiscal policy events.

CHAPTER 9 – EXOTIC OPTIONS[1]

There are a wide variety of exotic options available from most dealers. The fact that an option is labelled exotic does not mean that it cannot be simple to understand the payout profile nor does it mean that it cannot be of very practical use in risk and portfolio management. Exotic options are sometimes referred to as second-generation or nonstandard options. Exotic options are "exotic" from the market maker's perspective, since they usually require sophisticated hedging and pricing techniques, are usually difficult to trade and manage, and usually place more capital at risk. For these reasons, they may command a high premium.

9.1 Options on a Single Underlying Asset or Index

The first and simplest class of options involves one underlying asset or index and the price of that underlying asset or index on one specific date, the date of expiration. Standard put and call options are examples.

Binary Options

A binary (all-or-nothing) option is an exotic option linked to only one asset and one date, that is actually simpler than a standard option. Consider a binary option on the TSE 300 expiring in three months with a strike price of 4000 and a payoff of X. The binary option pays exactly $X, if and only if, the TSE 300 is above 4000 at the expiry date. Quite complex structures can be constructed by combining a group of binary options with various "laddered" strike prices and payoffs.

A second class of exotic options involves a single underlying asset or index, but the option involves the price of this underlying asset or index on more than one date. These are path-dependent options. Examples are compound options, extremum options, lookback options and average rate options. For extremum options, the value of the option depends on the maximum or minimum price achieved throughout the option period.

Lookback Options

A lookback option confers the right to buy an asset at its minimum price or sell it at its maximum price during a specified "lookback" period. A lookback call (put) is like the standard call (put), except that the strike price resets when the price of the underlying asset or index declines (increases). If the price of the underlying asset or index subsequently rises (declines), the strike price does not. The strike price stays at the lowest (highest) level attained by the underlying asset or index.

Lookback options have large premiums compared to standard options and so are not that useful in risk management. The premium can be reduced by reducing the frequency of "looking back" from daily to weekly to monthly, and by restricting the lookback period (last three months of a one-year option).

They can be useful if the investor is anticipating a wide fluctuation in values. If the market is also anticipating greater volatility, however, the premium will be that much greater.

A look forward call (put) confers the right to the difference between the highest (lowest) value of the underlying asset or index attained during the option term and the spot price at the beginning of the option period.

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[1] This chapter is based to some degree on Eric S. Reiner "Using Nonstandard (Exotic) Derivatives in Managing Portfolio Risk," *Derivative Strategies for Managing Portfolio Risk*, Association for Investment Management and Research, ed. Keith C. Brown, Charlottesville Va., 1993.

Barrier Options

The payoff from a European-style barrier option depends on whether or not the underlying asset or index ever crosses a value specified as the barrier and on the value of the underlying asset or index at expiration. A barrier above (below) the current value is an up (down) barrier.

Barrier options are most common in relation to specific stocks or stock indexes. However, barrier options have been sold where the barrier is a cap or floor rate on a floating rate index or where the barrier is an exchange rate or commodity price.

An "in" barrier option pays off only if the barrier is crossed. An "out" barrier option pays off only if the barrier is not crossed. There are thus four call and four put barrier options depending on whether the barrier is up or down and whether the option is in or out.

An out (in) barrier option is said to be knocked out (in) when the value of the underlying asset or index crosses the barrier. If you feel the probability of being knocked out is low, then out barrier options will seem cheap. If you feel the probability of being knocked in is high, then in barrier options will seem cheap.

If you own both an in and out barrier call (put) option with the same expiration date, strike and barrier, then you will receive the same payoff as if you own a call (put). For example, the value of a down and in call (put) plus the value of a down and out call (put) is equal to that of a call (put) option.

Barrier options make it possible to pay only for those outcomes that are consistent with your market views by eliminating the payoff on possible outcomes that you believe to be unlikely. Suppose you believe that the underlying asset or index is almost certain to increase in value above 103% of its current value. However, you also believe that if its value drops below 98% of its current value, it is almost certain not to appreciate significantly. You can buy a down and out call with a strike price of 103% and a barrier of 98%. A significant reduction in option premium results from the elimination of the payoff from those scenarios in which the underlying asset or index first declines below 98% and subsequently rises above 103% at the end of the exercise period.

Suppose you wish to hedge an asset from declines in value of more than 10%, but that you will sell the asset should it rise in value by more than 10%. Or suppose you are concerned about a major political event, whose outcome is difficult to predict. If the outcome is favourable, asset values will increase and continue to do so for many months. If the outcome is unfavourable, asset values will decrease and continue to do so for many months. A put option struck at 90% provides the downside protection, but continues to do so, even if the underlying asset or index appreciates by more than 10%, when you no longer need protection. Buying an up-and-out put with a strike price of 90% and a barrier of 110% matches your hedging needs exactly and at reduced cost.

Barrier options can be used to construct "ladder options." A ladder call option might provide the right to buy an asset at the current market price. If the asset rises 5%, 10%, 15% or 20% above its current level, then the payoff at maturity will be at least 5%, 10%, 15% or 20% of its current value. The ladder call option is constructed from a series of up-and-in barrier call options.

A binary up-and-in call (down-and-in put) option pays a fixed amount if the value of the underlying asset or index crosses the barrier from below (from above) during the option period. A capped (floored) European-style call (put) is like a regular call (put) except that if the value of the underlying asset or index crosses the barrier from below (from above), then the option terminates and the holder is paid the difference between the barrier and the strike either immediately or at the end of the option period.

Compound Options

A compound option is an option on an option. It consists of a put on a put or call, and a call on a put or call. An investor might want exposure to the underlying asset or index, but be reluctant to pay the full premium for a call option. He/she might be willing to pay something to fix the current premium for the call option should he/she subsequently conclude that he/she would like to own the call. The investor might be concerned that some future political, fiscal or monetary event might materially increase call premiums. If the underlying asset or index increased in value, or expected volatility increased, or interest rates, etc., increased prior to deciding to own the call, the call's premium would have increased. A call option on a call option would fix the premium on the underlying call, thereby locking in current market conditions. The option value depends on the date when the decision to buy the underlying call option expires as well as the date on which the underlying call option expires.

A chooser option allows the buyer to decide at (or prior to) a specified date whether the buyer wishes to have a put or call on the underlying asset or index. Upon choice, the option becomes a standard option. A complex chooser option involves a choice between a put or call with different strike price or expiry date. A chooser option may cost less than buying put and call options separately. This can be useful if some event is expected to establish a price trend in the underlying asset or index, but it is not clear in which direction. The put/call straddle position is costlier and provides unnecessary protection, (i.e., protection against the possibility of a reversal in trend after the event).

A forward starting option starts at some date in the future at a strike price set on that date. The option premium is fixed based on current market conditions. It locks in current pricing, if the investor is concerned about increases in option prices. It is often used in a ratchet structure where periodic payments are made equal to any increase in the underlying asset or index value.

Average Rate Options

The payoff on an average rate option depends on the average value of the underlying asset or index during the entire option period or a part of it. A sampling period such as daily close, weekly close or month end close would be chosen. The average may be arithmetic or geometric.

If cash flows are to be received approximately uniformly over a period of time and these cash flows are to be converted from one currency to another or invested in an underlying asset or index of a specific type, an average rate option is attractive. There is really no need to attempt to hedge each cash flow separately. The average rate option hedges the entire cash flow stream at once. This use of the average rate option is especially valuable in the context of foreign subsidiary earnings, where U.S. accounting rules require that foreign currency earnings be translated at average rates.

This type of option provides protection from a sharp drop in the value of the underlying asset or index just prior to option maturity. A standard option would lose most, or all of its value, whereas an average rate option would retain most of its value. Giving up the opportunity to gain from a last minute upswing in value may be a small price to pay for such protection.

The price of the average rate option will be less than the sum of the prices of the options on each cash flow, because its volatility will be less. The more frequent the sampling, the cheaper the option. This is a practical and popular type of option.

9.2 Options On Multiple Underlying Assets or Indices

A third class of exotic options called rainbow options involve options that depend on the value of multiple underlying assets or indices, portfolios of several asset classes or several currency exposures or any combination of these. A rainbow option depending on two (three,...) assets is a two (three,...) colour rainbow.

Derivatives involving a quanto (currency protection) feature, for example, enable the end user to enter into a swap, cap, floor, option, swaption or any other derivative defined in terms of one currency, while settling payments in another currency at a predetermined exchange rate. The payout in the predetermined currency does not depend on exchange rates. The premium for a quanto option may be less than the premium in the domestic currency of the underlying asset or index, if forward exchange rates at the time of option purchase anticipate a weakening of the payoff currency relative to the domestic currency. Quanto options are usually only settled in cash.

If Canadian dollar-based investors invest in the Japanese stock market, their Canadian dollar return depends on both the stock performance in Japanese dollars and the Canadian/Japanese dollar exchange rate. A quanto option might involve a call option on the Nikkei 225 index-linked to a fixed Canadian/Japanese exchange rate for the payoff on the call option.

An outperformance or "best-of" option pays the best performance of two or more underlying assets or indices, say, the better of the Nikkei and the TSE 300 indexes, where the Nikkei 225 index performance is after conversion to Canadian dollars. Outperformance options are expensive, but they are more likely to pay off at maturity than options on only one underlying asset or index. Outperformance options can be same currency and across multiple assets.

A relative performance option might pay the difference between or the ratio of two asset prices. An investor may believe the TSE 300 will outperform the S & P 500 in the next year. The investor might buy a one-year relative outperformance call option on the TSE 300 – S & P 500 index spread to implement this view.

A basket call (put) option pays any excess of two or more asset prices over (under) the strike price. A basket option on specific assets might fit investor needs better than an index option. It is usually cheaper than buying options on each underlying asset or index, because the volatility of the basket is less than the volatility of each underlying asset or index.

The fourth class of exotic options involves the value of multiple assets at more than one date. An average rate basket option, averaged across multiple currencies, would be an example. This could be useful for a company that has relatively uniform cash flows in many countries that it will convert back to home currency dollars on receipt. It would be especially useful in the context of a number of different foreign subsidiaries, where it was desirable to hedge their earnings back to U.S. dollars.

The price of an option on a basket of currencies can be materially less than the price of a set of options on each currency because the volatility of the basket will be less. In particular, the price of the basket option will decrease as the correlation between the basket currencies declines.

APPENDIX 1 – FACTORS IMPACTING THE INTEREST RATE SWAP SPREAD

Corporate Bond Spreads

The influence of corporate bond spreads on swap spreads can be understood by returning to the classical interest rate swap. From the perspective of the BBB corporation, the fixed swap rate equals the BBB longer term borrowing rate, less the difference between the BBB rate borrowing cost and the floating rate index, less the BBB corporation's share of the arbitrage opportunity exploited through the swap. In the example in Section 6.4.2, this would be 11.25% – .60 – .40 = 10.25%. The upper limit to the fixed swap rate applies, when the BBB corporation's arbitrage share is zero and equals the BBB long-term borrowing rate less the difference between the floating rate BBB borrowing cost and the index floating rate (i.e., 10.65%).

From the perspective of the AAA bank, the fixed swap rate equals the AAA bank fixed borrowing rate, less the difference between the AAA bank floating rate borrowing cost and the floating rate index, plus the AAA bank share of the arbitrage opportunity. In the example in Section 6.4.2, this would be 10.00% – .25 + .50 = 10.25%. The lower limit to the fixed swap rate applies when its arbitrage share is zero and equals the AAA bank fixed borrowing rate less the difference between the AAA bank floating rate and the index floating rate (i.e., 9.75%).

If the predominate players in the longer term swap market are (strong) AA and (weak) A corporations, then it is their borrowing costs that will tend to determine the upper and lower bounds of the fixed swap rate. The upper limit will be the A corporation fixed rate borrowing costs less the difference between the A corporation borrowing costs and the floating rate index. The lower limit will be the AA corporation fixed rate borrowing costs less the difference between the AA corporation floating rate borrowing costs and the floating rate index. The AA floating rate difference might be negative, if they can borrow at a rate below the floating index rate.

As in the case of the (strong) AAA bank and (weak) BBB corporation, the (strong) AA corporation can borrow more cheaply than the (weak) A corporation in both bond and money markets, but the greatest difference applies in the bond market. This creates an arbitrage possibility that fuels the swap market.

If the primary demand for interest swaps arises from corporate AA and A borrowing requirements, then the swap spread will tend to lie between corporate AA and corporate A bond spreads. This has been largely the case in the U.S.

Bank Paper and Canadian Swap Spreads

Banks are the major swap market makers in Canada and they are large issuers of fixed rate debt. In combination, these two factors imply that the bank credit spread in the new issues market is the primary determinant of fixed swap rate spreads in Canada.

If bank paper spreads widen relative to swap fixed rates, it will be cheaper for banks wanting to raise fixed rate debt to borrow at floating rates and to pay fixed swap rates. The floating swap payments that the bank receives are then used to cover the interest cost of their floating rate debt. In effect, they have created a source of fixed rate funds at a cheaper rate than available through direct issue of bank paper.

If bank paper spreads narrow relative to swap fixed rates, it will be cheaper for banks wanting to raise floating rate funds to borrow at fixed rates and to pay floating swap rates. The fixed swap payments that the bank receives are then used to cover the interest cost of fixed rate debt. In effect, they have created a source of floating rate funds at a cheaper rate than available through direct borrowing in the short-term market.

Interest Rate Expectations and Interest Rate Risk

If companies expect future rates to rise or the yield curve to steepen, they create a demand for swaps in which they make fixed payments in order to lock-in a relatively low fixed rate. If financial intermediaries are at risk from rising rates, they will create a demand for swaps in which they make fixed rate payments in order to reduce their interest rate exposure. The demand for swaps in which fixed payments are made will put pressure on the swap spread to widen.

The swap spread will tend to narrow to the extent that companies wish to float their debt in expectations of lower rates or a flatter yield curve and to the extent that financial intermediaries need to reduce their exposure to a decline in rates.

The impact of these factors can be short lived, but they can, on occasion, shift the spread beyond the upper and lower limits created by corporate borrowing rates or away from the rates indicated by bank paper rates.

Eurobond Issues

When a non-Canadian currency borrower issues in the Euro-Canadian bond market, they may want to swap out of the Canadian currency into their own domestic currency. To do this, they will enter into a Canadian dollar swap in which they receive fixed and pay floating. This converts the Canadian dollar debt from fixed to floating. They will also enter into a currency swap, in which they receive floating Canada and pay floating in their domestic currency. This converts their floating Canadian dollar debt to floating domestic currency debt. Finally, they will enter into a swap in their own domestic currency in which they receive floating and pay fixed. The combined result of the three swaps will fix the cost of their debt to them in their own currency.

From the perspective of the Canadian interest rate swap market, Canadian Eurobond issuance can create a demand for interest rate swaps in which the Eurobond issuer receives fixed payments. This will tend to reduce Canadian swap spreads.

If swap spreads narrow as a result of Euro-Canadian bond issues, the cost of issuing Canadian dollar debt will increase to a non-Canadian currency borrower. This increased cost will discourage Euro-Canadian bond issuance and take pressure off the fixed spread to narrow. The spread will then tend to widen again.

Investment Opportunities and Interest Rate Swaps

Asset transactions combined with simultaneous swap execution can influence swap spreads. Assets, such as Eurodollar bonds, mortgages, or MBSs that have a term longer than required by an institution to support its liabilities, may be purchased by an institution because of an attractive rate and then combined with a swap in which the institution pays fixed. The spread of the asset over the fixed rate is locked-in over the term of the swap. In effect, the institution has created a floating rate investment earning the floating rate plus the fixed spread. When this spread is wide, this type of asset-driven swap activity increases and swap spreads widen.

Cheap floating-rate investments that have a shorter term than required may be purchased and combined with a swap to receive fixed. In effect, a fixed rate instrument is created at a rate equal to the fixed rate plus the spread of the floating rate investment over the floating rate on the swap. When this spread is wide, this type of asset-driven swap activity increases and swap spreads narrow.

Swap Dealer Hedging Costs

Hedging costs can influence swap spreads. When a dealer agrees to pay fixed on a swap, the dealer will hedge by purchasing a government security with the same term as the swap. Typically, financing would be done through the short-term reverse repurchase market, since this would be cheaper than bank borrowing. The difference between the floating rate swap payment received by the dealer and the repurchase rate paid by the dealer represents a positive cost of carry. As this cost increases, the dealer will offer a higher fixed rate on the offsetting swap. Thus, swap spreads tend to widen as the floating rate repo spread widens.

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GLOSSARY

American-style options — An option which may be exercised any time prior to expiration of the option at the owner's choice.

Arbitrage — The simultaneous purchase and sale of essentially similar assets or financial instruments at a profit.

Arbitrage-free model — A model that does not allow arbitrage.

At-the-money — An option is at-the-money if the strike or exercise price equals the current value of the underlying asset or index.

Backwardation — Backwardation refers to the situation that obtains when the forward curve of futures prices is negatively sloped and, in particular, futures prices are lower than spot prices. *See contango.*

Barrier — The price or rate at which certain types of derivatives are activated or deactivated.

Basis — The basis, as it applies to futures, is the price of the futures contract less the spot price. In general, the basis is the difference between prices or yields for related instruments.

Basis swap — An interest rate swap in which counterparties exchange payments based on different floating rate indices such as prime and bankers acceptances.

Basis risk — Basis risk exists where there is not a perfect correlation between the change in value of the hedged position and the hedging instrument (i.e., that the basis may widen and losses occur).

Call option — A contract in which the buyer pays a fee (premium) in exchange for the right, but not the obligation, to buy a fixed amount of a specific commodity, currency, swap, futures contract financial asset or index at a set price on or before a specified future date.

Cap — An option that sets a ceiling on the purchaser's exposure to the underlying asset. An interest rate cap is a contract in which one counterparty (the seller) receives a premium from the other counterparty (the purchaser) for assuming an obligation to make periodic payments calculated on each payment date by multiplying a notional principal amount times the difference, if positive, between some variable reference rate and a fixed rate (the strike or cap rate), or zero otherwise. The purchaser selects the expiry date, the strike rate, the reference rate, the reset period and the notional principal amount. A cap can be constructed from a series of single period calls on an interest rate or a series of puts on single period futures contracts. A cap provides protection from increasing interest rates for floating rate debt and liabilities, while allowing the purchaser to benefit from dropping rates.

Cash settlement The closing of a derivative contract by marking it to market and settling the contract obligations by a cash payment rather than by the physical delivery of the underlying asset. Most financial derivatives and virtually all over-the-counter derivatives use cash settlement.

Collar The combination of purchasing an out-of-the-money cap (call option) and selling a floor (put option) with the same notional amount, maturity date and reference rate. The premium received on the floor (put) reduces the premium paid for the cap (call) purchased.

Collateralized mortgage obligation A collateralized mortgage obligation (CMO) is a bond by a pool of mortgages or mortgage-backed securities.

Contango Contango refers to the situation that obtains when the forward curve of futures prices is positively sloped, and, in particular, futures prices are higher than spot prices. *See backwardation.*

Counterparty risk The risk that the counterparty to a contract will fail to meet the terms and conditions of the contract.

Covered call option A call option is covered if the writer of the call option owns the underlying asset or index, or owns an offsetting call in an mount equal to or greater than the written call option amount.

Covered put option A put option is covered if the writer of the put option owns an offsetting put option or sets aside sufficient cash dedicated to the purchase of the underlying assets or index should the put option be exercised.

Cross currency basis swap A floating-flating currency swap.

Cross currency swap A fixed-for-floating currency swap.

Currency forward A contract to exchange specific amounts of one currency for another at a future date. The exchange rate used reflects the differential in interest rates in the two currencies to the future date so as to eliminate risk-free arbitrage.

Currency swap A bilateral contract in which one counterparty agrees to the spot sale or purchase of one currency for another and enters into a simultaneous forward agreement to repurchase agreed currency amounts at the maturity of the swap. In addition, there is agreement by the one counterparty to make periodic payments in one currency in exchange for the other counterparty agreeing to make periodic payments in another currency at specified intervals known as payment or settlement dates. The periodic payment is calculated by multiplying the amount of the underlying in the relevant currency (the notional principal amount in that currency) times a fixed or floating reference interest rate defined in that currency.

Delivery month The month in which a futures contract is to be settled. The seller of the futures contract may settle any time within the delivery month.

Delta The ratio of the price sensitivity of an option to small changes in the price of the underlying asset or index. It is the first partial derivative of the option price with respect to the price of the underlying. Delta lies between –1 and +1 and can be interpreted as the probability of a call option expiring in the money. An at-the-money option has a delta of .5.

Delta hedging A strategy for hedging option exposure through the purchase or sale of the underlying asset in proportion to delta. Changes in the price of the option position arising from small changes in the price of the underlying asset will be offset by changes in the asset position, if the amount of the underlying is delta times the option exposure. A delta hedge may need frequent rebalancing since delta is a function of the price and volatility of the underlying asset, the time to option expiry and interest rates.

Derivative A derivative transaction is a bilateral contract whose value is based on the value of an underlying asset, currency exchange or interest rate or index.

Equity index swap A swap in which floating rate payments are exchanged for payments based on the returns on an equity, sub-index or basket of stocks plus or minus a fixed spread. To hedge the swap, the payer of the index borrows at a rate based on the floating index and buys the index.

Embedded option An option embedded in a fixed income instrument. The option can be on any type of instrument and may impact the amount and timing of payments. Callable bonds and prepayable mortgages are examples of fixed instrument with embedded call options.

European-style option An option which may be exercised only on the option expiry date.

Exercise price The set price at which the option owner can buy (call) or sell (put) the underlying asset or index, upon exercise of the option.

Exercising an option To act on the right to buy or sell an asset or index at the strike price.

Floor An option that sets a floor on the purchaser's exposure to the underlying asset. An interest rate floor is a contract in which one counterparty (the seller) receives a premium from the other counterparty (the purchaser) for assuming an obligation to make periodic payments calculated by

multiplying a notional principal amount times the difference, if positive, between a fixed (strike or floor) rate and some variable reference rate or zero otherwise. A floor can be constructed from a series of single period puts on an interest rate or a series of calls on single period futures contracts.

Forward contract A contract obliging one counterparty to buy and the other to sell a set amount of a specific asset, currency or index of assets at a set future date at a set price. The value of the contract at maturity may be settled through delivery of the underlying or through cash payment. Forward contracts are tailored through negotiation to fit the specific situation and objectives of the counterparties.

Forward exchange rate agreement A forward exchange rate agreement (FXA) is a bilateral contract in which counterparties agree to pay an amount calculated by multiplying a notional principal amount times the difference between the forward exchange rate at the start of the contract and the spot exchange rate at a specified future payment date. One party pays if the spot rate at maturity is higher than the contracted rate and vice versa, if it is lower.

Forward (interest) rate agreement A forward (interest) rate agreement (FRA) is a bilateral contract in which counterparties agree to pay an amount calculated by multiplying a notional principal amount times the difference between a contracted rate and the actual reference index rate at a specified future payment date. One party pays the other, if the actual rate is higher than the contracted rate and vice versa, if the actual rate is lower. FRAs are referred to on the basis of the number of months to the start and end of the FRA. A three-month FRA starting one month forward is a 1x4 FRA. FRAs are the building blocks of interest rate swaps.

Forward price The price specified in the forward contract at which the asset will be bought or sold at the transaction date.

Forward swap A forward swap is a swap in which the periodic exchange of payments required by the swap does not commence until some specified future date.

Futures contract An exchange-traded contract obliging the owner to buy a set amount of a specified asset, currency or index of assets at a set future date at a set price. Contracts are usually marked-to-market on a daily basis, with daily profit and loss payments. Contract terms are fully standardized so that contracts of the same maturity on the same underlying are perfect substitutes. This fungibility facilitates anonymous trading in an active and liquid market. Contracts are entered into directly with the exchange clearing house and are

	generally settled through the acquisition of an equal but opposite position.
Gamma	Gamma is the second derivative of the value of the option with respect to the price of the underlying asset or index. Gamma measures the change in delta for a one-unit change in the price of the underlying. Gamma indicates the frequency with which a delta hedge will need to be rebalanced to maintain the hedge. A high gamma indicates frequent rebalancing will be required to avoid material losses. Gamma is highest for at-the-money options and decreases the further the option is away from being at-the-money.
Hedge	To reduce risk by taking a position which offsets an existing or anticipated risk exposure to adverse changes in the value of an asset, liability or surplus position.
Initial margin	A small percentage of the futures contract face amount that must be deposited by an investor at the time a futures position is established as a “good faith deposit.”
Interest-only strip	Interest-only strip (IOs) are securities backed by a pool of mortgage-backed securities, which entitle the investor to receive only the interest payments on the mortgages or mortgage-backed securities. Rising interest rates result in less mortgage refinancing and, hence, more interest payments and higher returns on the IOs. Returns are lower if rates fall and more mortgage refinancings occur.
Interest rate swap	A bilateral contract in which two counterparties agree to make periodic same currency payments to each other at specified intervals known as payment or settlement dates. The periodic payment amount is calculated by multiplying the amount of the underlying (notional principal amount) by a specified reference interest rate that may be fixed or variable. The swap may be tailored through negotiation to fit the specific situation and objectives of the counterparties. Interim payments are usually netted with the counterparty with the largest amount to be paid paying the net amount to the other counterparty.
In-the-money	A call (put) option is in-the-money, if the strike price is less (greater) than the current value of the underlying asset or index.
Intrinsic value	The intrinsic value of an option is the difference between the current price of the underlying asset or index and the option strike price if positive, and zero otherwise.
Leverage	The exposure to the value change in a large amount of an asset arising from a small payment. Options and futures are leveraged because, with a small payment, the purchaser

	becomes exposed to the change in value of a much larger amount of the underlying.
LIBOR	London interbank offered rate. The rate at which banks offer to lend funds in the international interbank market.
Marking-to-market	Valuing an asset or liability based on current market prices.
Notional principal (amount)	An amount used to calculate the payments owing on swaps and other derivatives. In an interest rate swap, the notional principal amount is multiplied by the applicable interest rate to determine the amount to be paid. In an interest rate swap, the notional principal amount is not exchanged.
Omega	Omega is the third derivative of the option price with respect to the price of the underlying.
Option contract	A contract in which the buyer pays a fee (premium) in exchange for the right, but not the obligation, to buy or sell a fixed amount of a specific commodity, currency, swap, futures contract, financial asset or index at a set price prior to or at a specified future date.
Option premium	The amount paid by the option purchaser for the option.
Option spread	The combination of purchasing a call (put) at one strike price and the sale of an otherwise identical call (put) at a higher (lower) strike price.
Option writer	The counterparty that sells an option.
Out-of-the-money	A call (put) is said to be out-of-the-money if the strike price is greater (less) than the current value of the underlying asset or index.
Over-the-counter	The purchase or sale of financial instruments transacted off organized exchanges.
Path dependent option	An option whose value depends on the value of the underlying asset or index at more than one date.
Principal-guaranteed note	A bond in which the return of principal (or a high percentage of it) is guaranteed by the issuer, but in which the income earned on the bond is based on the change in the return from a given currency, commodity, market index, yield curve or interest rate relationship if positive, and zero otherwise. They are hedged by buying a zero-coupon bond with the same maturity as the note and buying a call option on the given currency, etc.
Principal-only strip	Principal-only strips (POs) are securities backed by a pool of mortgages or mortgage-backed securities, which entitle the investor to receive only principal payments on the mortgages or mortgage-backed securities. Falling interest rates result in more refinancing and hence principal payments are

	received faster and returns are higher on the POs. Returns are lower if rates rise.
Put option	A contract in which the buyer pays a fee (premium) in exchange for the right, but not the obligation, to sell a fixed amount of a specific commodity, currency, swap, futures contract, financial asset or index at a set price on or before a specified future date.
Repurchase agreement (repo)	An agreement in which securities are sold to a counterparty with a simultaneous agreement to repurchase the same securities from the counterparty at a fixed price at a fixed future date.
Rho	Rho is the ratio of the change in an option price to a change in interest rates.
Settlement	The completion of a contract wherein securities or financial instruments are transferred from the seller to the buyer in exchange for cash.
Settlement risk	The risk that a counterparty to whom one has delivered assets or cash will fail to transfer the cash or assets due from them on delivery.
Spot rate	Applied to currencies, it is the current exchange rate for a currency. Applied to interest rates, it is the rate at which a single payment at a future time is discounted back to the present. Each future time has its own spot rate.
Straddle	A long (short) straddle is the purchase (sale) of a put option and a call option on otherwise identical terms. If the price of the underlying asset is volatile enough, the long straddle position will settle for more than the accumulated value of the two premiums paid. A straddle is thus a trading position on volatility.
Strangle	A long (short) strangle is the purchase (sale) of a put option and a call option on the same underlying with the same expiry date, but with the strike price lower than the call strike price. Often both options are equally out-of-the-money. A strangle is a trading position on volatility that involves payment of a smaller amount of premium than a straddle, but requires a greater price movement to pay off.
Strike price	The same as exercise price.
Swaption	A swaption is a contract in which the buyer has the right, but not the obligation, to enter into a specific swap on or before a specified future date.
Structured note	A bond with return of principal and/or interest based on the

	change in, or return from, a given currency, commodity, market index, yield curve or interest rate relationship.
Theta	Theta is the negative of the ratio of the change of an option price to a change in expiration date. Theta decreases with increases in the difference between the spot and strike price. Theta decreases more and more rapidly the closer the option is to expiry.
Transatlantic option	An option which may be exercised before maturity at the owner's choice, but only at specific dates.
Variation margin	An amount equal to the actual daily change in price of the futures contract position that must be paid by or will be paid to the investor each day.
Vega	Vega is the ratio of the change in an option price to the change in the volatility of the underlying asset or index. The first derivative of the option price with respect to volatility. Vega is always positive. Vega is highest for at-the-money options and decreases the more the option is out-of-the-money. Vega increases with time to expiry.
Warrant	A traded security that gives the owner the right to purchase or sell a set amount of an asset or index to the warrant issuer under specified conditions for a specified time.