Index Derivatives

Reference Manual

TMX Group

Equities
Toronto Stock Exchange
TSX Venture Exchange
Equicom

Derivatives
Montréal Exchange
CDCC
Montréal Climate Exchange

Fixed Income
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The masculine form used in this document designates without discrimination both women and men.

Introduction

The movement of stock market indices is a key component of financial news. Investors' interest in stock market indices largely results from the increasing popularity of the "index" portfolio management style, which consists in building portfolios that mirror stock market indices. For example, in Canada there are several Canadian equity mutual funds that reproduce the leading stock market indices such as the S&P/TSX 60 Index. Pension fund administrators have also adopted this management method.

In September 1999, the Montréal Exchange listed futures and options contracts on the S&P/TSX 60 Index. Later, in March 2000, options on the iShares CDN S&P/TSX 60 Fund were introduced. Futures contracts on sectorial indices are also listed. With these products, investors and traders can enjoy the following benefits:

- broad equity diversification with a single transaction;
- transaction costs that are markedly lower than with other products;
- actively quoted markets with transparent pricing;
- flexibility to enter and exit the market at any time during the trading day;
- no restriction for short-selling the market;
- mitigation of counterparty risk considerations because of daily cash settlements of trading gains and losses;
- liquidity (namely, narrow bid-ask spreads) as a consequence of concentrated trading activity in standardized contracts with broad-based market appeal;
- no replication error when adding or retracting stocks from the index.

Equity indices and sectorial indices: what are they and why are they important?

One of the tenets of modern portfolio theory is that the risk of holding equity positions can be reduced by maintaining a diverse portfolio of stocks, rather than a concentrated position in a limited number of equity issues or in a narrow sector of the market. The challenge to investors, then, is to assemble a portfolio of stocks that will maximize the expected return for a given measure of risk. Portfolios that satisfy this objective are said to be "efficient portfolios".

An efficient portfolio can be constructed by assembling a basket of equities that corresponds to the overall make-up of an economy, weighting each stock so that it reflects its relative share of the total capitalization. The S&P/TSX 60 Index, in fact, represents just such a capitalization-weighted portfolio.

Put another way, the S&P/TSX 60 Index is an equity portfolio composed of 60 highly liquid Canadian equities and selected as a representative sampling of sectors of the Canadian market: basic materials, capital goods, communication service, consumer cyclicals, consumer staples, energy, financial, health care, technology, transportation and utilities. The composition of the index within each sector is specifically engineered to make it easy to replicate the index by actually buying the shares. To do this, the weight of each stock in the index would be determined by that stock's capitalization value, relative to the total capital value of the 60 stocks combined.[1]

Standard & Poor's Corporation calculates and disseminates index prices that reflect the current value of this hypothetical portfolio on an ongoing basis, using the latest traded prices of the component stocks. It sets the value of this hypothetical portfolio at a value of 100 based on the closing prices of the stocks on January 29, 1982. Analysts can use this index to measure the rate of the stock market's appreciation (depreciation) over any historical period by calculating the ratio of the two index prices at the given times. For instance, at the end of 2005, the value of the S&P/TSX 60 Index was 635.89, and at the end of 2006, it was 742.77. The ratio (742.77/635.89) equals 1.168, reflecting a return of 16.8% for 2006.

It is important to note that the index varies **only** because prices of the underlying component stocks change. In particular, the index is unaffected by payments of dividends and/or any changes in the composition of the index.[2]

In their early days, index portfolios mainly reproduced large stock market indices. But in the past few years, a growing number of sectorial index portfolios have emerged, modeled after the sectorial components of large stock market indices. The energy and telecommunications sectorial indices are two well-known examples. Each sectorial index (commonly known as "sub-indices") tracks a particular basket of stocks of companies whose primary activities are the index's specific economic sector. These sectorial indices help to better control the exposure of a portfolio in a specific Canadian economic sector.

[1] Capitalization is adjusted to exclude the value of shares held by other index constituents or by other shareholders who control 20 percent or more of the stock.

[2] The Standard & Poor's Corporation will modify the index following mergers, acquisitions, or other events that make the composition of the index less representative of the overall Canadian market. When the composition of the index is altered, the index value is multiplied by a new factor. This adjustment ensures that users get meaningful results when comparing index values at two different points in time, even though the index's composition may not be the same on those two occasions.

What is a futures contract and how does it work?

A futures contract is an exchange-traded contract that is used for both hedging (i.e., risk management purposes) and trading (i.e., speculation for income generation). The buyer of a futures contract establishes a long position; the seller establishes a short position. Subsequent to the initiation of a position, futures contracts require a daily cash adjustment to reflect the value of any change in price. With rising prices in the futures market, short positions holders' must pay cash and long positions holders' receive cash in their accounts. With falling prices, long position holders' pay and short position holders' receive. Conversely, the seller of a futures contract can close his position by buying back the contract sold.

If the investor wishes to hold his position beyond the expiration date, he can "roll" his initial position by selling the contracts initially purchased or buying what he initially sold and then take the same position on the following contract month.

Hedgers use futures contracts to fix a price for an anticipated purchase or sale. Those exposed to the risk of prices going higher will buy futures or enter into long positions; those exposed to the risk of prices going lower will sell futures or enter into short positions. In either case, gains generated by the futures contracts will compensate for adverse changes in the level of the underlying index; or, alternatively, losses from the futures will be applied against any beneficial price changes in the level of the underlying index. Thus, the hedge serves to eliminate both risk **and** opportunity. In a perfect hedge, where the exposure to changes in the level of the portfolio hedged precisely matches the changes in the price of the futures contract, the ultimate outcome is that the hedger will lock in the price of the futures contract. He will therefore not gain or lose on the transaction no matter what happens in the markets.

Before a trade can be executed in the futures market on the Exchange, customers must post an **initial margin** or good-faith deposit with their brokers, who in turn will post collateral with the Canadian Derivatives Clearing Corporation (CDCC). Subsequently, futures positions are marked-to-market, based on each day's closing price, with gains and losses settled by a daily cash transfer between the long and short position holders. This exchange of cash is known as **variation margin**. The CDCC acts as an intermediary in this process and guarantees each side's solvency, thereby eliminating the concern of counterparty risk.[3]

Buying or selling a futures contract requires transacting through a broker who is an approved participant of the Montréal Exchange. Market orders to buy futures contracts will be executed at the offer price (ask); market orders to sell will be executed at the bid price (bid). However, an investor wishing to buy or sell at a specific price can give a limit order. This order will be registered in SAM's (Montréal Automated System) electronic order book and will be executed when a counterparty will be interested at that price. Orders will then be matched and both orders will be filled at the specific price for the smallest quantity posted. Because all of the trading of any specific futures contract is concentrated on one trading platform, participants will always be assured of buying at the lowest offer price or selling to the highest bid.

[3] The collateral deposited with the clearing corporation serves as a safeguard to insure that it is able to pay the gains to the deserving counterparties.

What is an equity index futures contract?

An equity index futures contract's price will follow the level of a hypothetical portfolio of stocks (the index). It is a convenient tool that lets investors either increase or decrease their exposure to the Canadian equity market. For example, given the decision to add to an equity position in an S&P/TSX 60 portfolio, investors have two choices: (1) they could buy the individual stocks of the S&P/TSX 60 directly in the stock market, or (2) they could buy (or go **long**) the S&P Canada 60 Index futures (SXF). Similarly, instead of selling stocks from a portfolio, they could continue to hold the stocks and sell S&P Canada 60 Index futures (enter **short** futures positions).

Theoretically, these alternative ways of adjusting equity exposure should offer the same economic result **as long as the futures are fairly priced**. Put another way, if the futures contract trades at a price equal to its **theoretical fair value**, the investor should not care whether trading occurs in the stock market or the futures market. This is true only if trading fees, which are generally lower in the futures market, are not taken into account.

Mathematically, this theoretical futures price is expressed, in practice[4], as follows:

$$F = S\left(1 + (i - d)\frac{t}{365}\right)$$

Where **F** is the theoretical fair value of the futures contract;
S is the spot index value;
i is the interest rate reflecting the cost of funds;
d is the dividend rate; and
t is the number of days remaining until the expiration of the futures contract.

Importantly, deviations between actual futures prices and theoretical prices are kept in check by the process of arbitrage, which involves simultaneously buying whichever is cheaper (i.e., futures or stocks) and selling whichever is more expensive, bringing the futures price closer to its theoretical fair value. This activity is the investors' safeguard that the prices in the futures market will be reflective of competitive market forces.

[4] In modern financial literature, interest is calculated on a continuous basis. Increasingly, traders and arbitrageurs are opting for this type of calculation rather than the more traditional method of calculating interest on a daily basis. The formula for calculating interest on a continuous basis is $F = S \times e^{(i-d) \times t/365}$ where **F** is the theoretical value of the futures contract; **S** is the spot index level; **i** is the interest rate representing the cost of money; **d** is the dividend rate; **t** is the number of days until the futures contract's expiration.

Beyond the pricing issue, a further concern when considering the use of futures contracts is transaction costs. Bearing in mind that (a) any trade in the stock market will require trading 60 separate stocks and a trade in the futures market will entail paying commission on only one trade and (b) the cost of trading includes both commissions and bid/offer spreads, investors quickly realize that trading in the futures market is substantially less expensive than trading in the stock market. This is particularly significant for investors whose objective is to temporarily adjust their equity exposure.

Variation margin for a single S&P Canada 60 Index futures contract is calculated by multiplying the daily price change of the futures contract by C$200 (the contract multiplier). For example, if an investor buys 10 S&P Canada 60 Index futures contracts at a price of 735.30 and that day the market closes at 735.90, the variation margin will be:

10 contracts x (735.90 – 735.30) x C$200 = C$1,200

Given this margining process, it should be evident that holding long stock index futures position is essentially like holding a mutual fund that replicates the S&P/TSX 60 Index, but where gains or losses are settled in cash, daily.

1. Using futures contracts for directional views

Suppose you think the Canadian stock market will go up. You make the assessment that it's a good time to enter into a long position with S&P Canada 60 Index futures contracts. Each contract may be regarded as covering an equity exposure equal to the value of the contract times the contract multiplier of C$200.

Thus, with the value of the contract, hypothetically at 735.30, each contract reflects an equity position worth 735.30 x C$200 = C$147,060. A long position will gain (or lose) as the futures price goes up (or down). A 10% change in the level of the index would thus be expected to correspond to a price change of the futures contract of roughly 73.53 for a total gain or loss of 73.53 x C$200 = C$14,706 per futures contract.

2. Using futures contracts for hedging

Suppose you have a portfolio of Canadian stocks that matches the composition of the S&P/TSX 60 Index. Currently, the value of this portfolio is C$5 million with the S&P Canada 60 Index futures contract at a level of 735.30. In your view, the stock market is due for a temporary correction. In the long run, you remain bullish and you want to keep your shares, but in the short term you want to hedge your risk. You want to cover this exposure by initiating a short futures hedge that you will maintain until the expected correction runs its course. During this period, you will continue to earn dividends on your stocks and you will still realize any appreciation or depreciation on these shares, depending on the direction of the market. With an open short hedge in place, however, you will also generate an offsetting loss or profit that should effectively neutralize your equity market exposure.

To achieve this objective, the hedger must base the size of the futures position on the size of the exposure, using the following formula:

$$N = \frac{V \times \beta eta}{SXF \times C\$200}$$

Where **N** is the required number of futures contracts;
V is the value of the equity position that you want to hedge;
ßeta is the sensitivity measure of the portfolio in relation to the index;
SXF is the value of the S&P Canada 60 Index futures; and
C$200 is the multiplier for the futures contract.

Substituting the appropriate values into the equation, N is calculated as follows:

$$N = \frac{C\$5 \text{ million} \times 1.3}{735.30 \times C\$200} = 44 \text{ contracts}$$

Table 1 generates the prospective outcomes under two alternative scenarios; with the market rising in Scenario A and falling in Scenario B. These examples show that in both market scenarios, despite significant changes in stock market values, the hedge immunizes the value of the portfolio almost perfectly from the effects of the respective market moves. Of course, if the index value increases contrary to investor's expectations (scenario A), the value of the portfolio would benefit from any appreciation of the index had the investor not hedged his portfolio. By hedging his portfolio with futures contracts, the investor "freezes" the value of the portfolio. He does not want to speculate up or down.

Table 1: Hedging a portfolio of S&P/TSX 60 stocks

Starting conditions

S&P/TSX 60 Index	728.94
S&P Canada 60 Futures	735.30
Portfolio value (C$)	5,000,000.00
Futures positions (short)	44 contracts

Ending conditions — Scenario A (Index appreciates 10%)

S&P/TSX 60 Index	801.03
S&P Canada 60 Futures	807.05
Portfolio value (C$)	5,650,000.00
Rise in portfolio (C$)	650,000.00
Futures loss (C$)	(631,400.00)
Net profit (C$)	18,600.00
Portfolio + Hedge, combined value (C$)	5,018,600.00

Ending conditions — Scenario B (Index depreciates 10%)

S&P/TSX 60 Index	656.05
S&P Canada 60 Futures	660.05
Portfolio value (C$)	4,350,000.00
Loss in portfolio (C$)	(650,000.00)
Futures profit (C$)	662,200.00
Net profit (C$)	12,200.00
Portfolio + Hedge, combined value (C$)	5,012,200.00

As these hypothetical hedges demonstrate, some degree of imperfection should be expected. First, because futures contracts must be traded in whole numbers (half-contracts cannot be traded), some rounding difference in implementing a hedge is virtually unavoidable. Secondly, a perfect hedge requires identical price changes for the futures contract and the portfolio hedged, respectively; but this does not always happen. Before the expiration of the contract, futures prices will differ from the underlying index value by the amount of the basis. However, upon the expiration of the contract (which occurs on the third Friday of the contract month), its value will converge towards the value of the underlying.[5]

[5] The final futures settlement price is equal to the official opening level of the S&P/TSX 60 Index on the expiration date.

3. Using futures contracts for exchange for physical — synthetic strategy

One of the more popular strategies for stock index futures is the strategy that strives to outperform the underlying index. This orientation is particularly appropriate for institutional managers whose performance is measured relative to a benchmark index. Consider the investor who has the objective of beating the S&P/TSX 60 Index. The S&P Canada 60 Index futures contract provides the means to succeed.

As discussed above, the long futures contract serves as a surrogate position for holding the individual shares of the S&P/TSX 60 Index; and, if correctly priced, the investor should be indifferent between holding the actual shares on one hand, versus maintaining a long futures position on the other. In fact, while arbitrage activity will tend to keep futures contracts within the vicinity of their fair values, some degree of mispricing should be expected. As a consequence, if one is able to switch between the futures and the stocks while always maintaining exposure in the relatively cheaper alternative, the end result will outperform that of the static, shares-only equity position.

Mechanically, this strategy often relies on the use of **exchange for physical (EFP)** transactions. In executing an EFP, the investor simultaneously buys (sells) a futures position and sells (buys) a shares position, where the negotiated price is the **basis**, or the difference between the futures price and the S&P/TSX 60 Index value. On SAM's electronic order book, both a bid and an ask are continuously posted on the EFP. This market is therefore transparent and it is very easy to find the best possible price.

What is a sectorial index futures contract?

Sectorial index futures contract works essentially in the same manner as the S&P Canada 60 Index futures contract. The difference is that sectorial index futures contract covers a specific Canadian economic sector.

The nominal value of each contract varies with the economic sector. Suppose an investor purchases a futures contract on the S&P/TSX Capped Information Technology Index expiring in June. If this futures contract is currently at 35.45, the investor undertakes to pay, at the expiration date of the contract, a price equal to C$17,725, that is 35.45 x C$500 (nominal value of the S&P Capped Information Technology futures contract). In return, the investor will receive C$500 multiplied by the level of the contract on the expiration date.

Investors are not obligated to hold a futures contract until its expiration date. They can reverse their initial position before expiration. In the example above, the buyer of a futures contract on the S&P/TSX Capped Information Technology Index can cancel his position completely by selling, before the expiration date, all contracts initially purchased. In doing so, the investor will realize (in the sense of "cash in") a capital gain or capital loss corresponding to the difference between the price at which he sold the contracts and that at which he initially purchased them.

Thus, the investor initially undertook to purchase the S&P/TSX Capped Information Technology stocks for an initial monetary commitment of C$17,725. If he subsequently sold the futures contracts at the level of 44.00, the initial position would then be cancelled, and the investor would pocket a profit of C$4,275, namely: (44.00 – 35.45) x C$500. This amount would then be deposited in his account, which was opened during the initial purchase so that the investor could make a margin deposit.

1. Using futures contracts for directional views

If, on the contrary, the investor anticipates that the value of the sectorial index will decrease, he can simply sell two futures contracts at 30.00 and reverse this position when the anticipated plunge occurs. The following table illustrates the details of this example. Note that if the underlying sector index were to rise instead of fall, the investor would then incur a loss.

Scenario 1: The index and the contract are worth 27.00 each at expiration
Gain on futures contracts initially sold: C$3,000 = [(30.00 – 27.00) x C$500] x 2

Scenario 2: The index and the contract are worth 36.00 each at expiration
Loss on futures contracts initially sold: – C$6,000 = [(30.00 – 36.00) x C$500] x 2

2. Using futures contracts for hedging

A pension fund has a portfolio of Canadian common stocks currently worth C$300,000,000. About 10% of this portfolio is comprised of S&P/TSX Capped Information Technology stocks, a sector in which the administrator's financial analysts foresee a correction within the next three months. Instead of liquidating this portion of the portfolio and reconstituting it once the correction takes place, the fund managers can offset the exposure of their portfolio by selling futures contracts on the S&P/TSX Capped Information Technology sector that expire in three months. If the underlying stock index is presently situated at a level of 34.30, the three-month futures contract should be worth about C$34.66, given a three-month risk-free rate of 6.20% and an index annual dividend yield of 2%.

$$F = 34.30 \left(1 + (0.062 - 0.02) \frac{91}{365} \right) = C\$34.66$$

The easiest way to obtain the hedging objective is for the managers to sell about 1,731 futures contracts:

Value to hedge:

C$300,000,000 x 10% = C$30,000,000

Number of futures contracts to cover the position (given a beta of 1 for the stocks comprised in the S&P/TSX Capped Information Technology Index):

$$\frac{\text{C\$30,000,000 x 1}}{\text{34.66 x C\$500}} \approx \text{1,731 contracts}$$

Suppose that the stocks of companies operating in this sector experience a 15% correction two months (not three) after the hedging position is taken. At this time, the level of the underlying sector index would be 29.15 and the futures contract initially sold would be worth C$14,575 (29.15 x C$500). The following situation then occurs (given a 5% one-month risk-free rate):

$$F = 29.15 \left(1 + (0.05 - 0.02) \frac{30}{365} \right) = 29.22$$

Loss incurred on the portion of the portfolio invested in technology sector stocks (C$30,000,000 x 15%)	– C$4,500,000
Gain on 1,731 futures contracts [1,731 x C$500 x (C$34.66 – C$29.22)]	+C$4,708,320
Net variation in position covered	+C$208,320

At this point, if the managers are convinced that the anticipated correction has occurred in full, they can simply cancel the hedge by buying back the 1,731 futures contracts initially sold to pocket their profit on the futures market.

By selling futures contracts on the S&P/TSX Capped Information Technology Index instead of selling the stocks held in the portfolio and later buying them back, the managers have reduced their workload and realised substantial savings in transaction and market spread (**bid/ask**) fees.

3. Using futures contracts for arbitraging

When the futures contract is undervalued and the price of the underlying asset is rising, an institution can simply purchase the contract and speculate on upcoming fluctuations, as explained above.

Such speculative positions nonetheless carry fairly high risks. An institution can profit from a poor valuation of the contract by instead adopting an arbitrage position that consists in selling the contract and borrowing funds to simultaneously purchase the underlying asset, and then holding this position until the contract expires. In doing so, it speculates on the spread between the price of the futures contract and that of the underlying index,[6] which constitutes a less risky position than simply selling the contract. An institution can also lower its risks by selling one contract that expires on a certain date and by buying another contract that expires on a different date.

[6] This spread is called the basis.

A good understanding of these strategies calls for a brief discussion of evaluation models of futures.[7] When interest rates are fairly stable, the following formula provides the "theoretical" fair value of a futures contract:

$$F(t,T) \approx S(t) \times e^{(r - D) \times (T - t)/365}$$

Where **F(t,T)** is the value on date t of futures contract expiring on date T;

S(t) is the level of the sector sub-index on date t multiplied by the nominal value of the contract;

r is the interest rate (annual nominal) with no risk[8]; and

D is the estimated dividend yield of the sector index.

For example, assume that the value of the underlying index (S(t) x C$200) is C$22,000, the annual interest rate (r) with continuous compounding is 0.062, there are 21 days before expiration (= T – t) and the estimated annual dividend rate with continuous compounding is 0.02. In this case:

$$F(t,T) \approx \text{C\$22,000} \times e^{(0.062 - 0.02) \times 21/365} \approx \text{C\$22,053.23}$$

In this example, if the price of a futures contract is greater than C$22,053.23 then it is overvalued; if the price is lower, the futures contract is undervalued. Such imbalances, which may not last too long, present trading opportunities for financial institutions that have minimal transaction costs.

A financial institution can seize this classic arbitrage opportunity by buying an undervalued futures contract while selling the underlying asset short on the spot market. There is also a model for calculating the spread between two futures contracts on the same sectorial index, but with different expiration dates. This model consists in applying equation (1) to the two contracts, the first expiring on T1 and the other on T2 (T2 > T1), to obtain the formula below[9]:

$$F(t,T2) - F(t,T1) = S(t) \times (e^{(r - D) \times (T2 - t)/365} - e^{(r - D) \times (T1 - t)/365})$$

[7] For more details on evaluation of futures see, for example, Chapter 2 of J. Hull, OPTIONS, FUTURES AND OTHER DERIVATIVES, 5th edition, Prentice Hall, 2005.

[8] In general, Canadian financial establishments use the same annual nominal rate as pensions buybacks, commonly known as the "repo rate."

[9] In this example, the dividend yield (D) is presumed to be the same from the initial date (t) to the most distant expiration date (T2). More sophisticated arbitrage models can be obtained if the dividend yield D is modelled as a random variable.

To use the data from the previous example, assume that the second contract expires in 112 days (T2 – t = 112). In this context, the difference between the prices of the two contracts should be C$232.13:

Theoretical spread between F(t,112) and F(t,21):

$$C\$22{,}000 \times e^{(0.062 - 0.02) \times (112/365)} - C\$22{,}000 \times e^{(0.062 - 0.02) \times (21/365)} = C\$232.13$$

In assuming that the risk-free rate is the same, namely 6.20%, for T1 and T2.

If the spread between the prices of the two contracts is greater than C$232.13, this means that the "distant" contract (that expires at T2) is overvalued compared with the closer contract (that expires at T1). To profit from this imbalance, an institutional investor can simply sell the distant contract and simultaneously purchase the near-term contract.

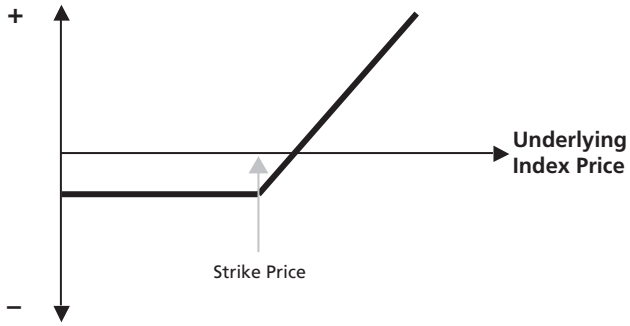
What is an option and how does it work?

Options come in two types: calls and puts. A call is the right, not the obligation, to buy a specific amount of an underlying at a pre-determined price (the **strike** or **exercise price**) within a specified time period. A put is the right, not the obligation, to sell a specific amount of an underlying at the strike price within a specified time period.

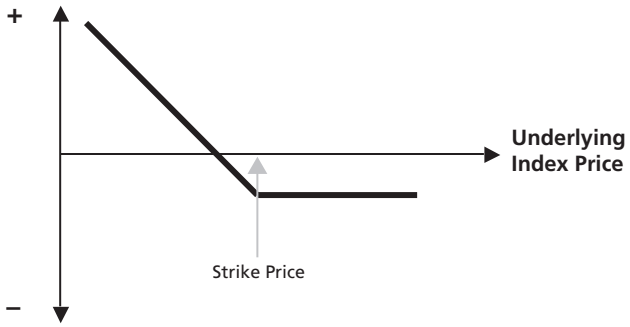
Unlike futures contracts, when an option is traded, option buyers actually pay (and sellers receive) the price (or **premium**) of the option. Subsequently, option buyers have the right, but not the obligation, to exercise their option on the expiration date. This means that if a buyer of the April 740.00 call option wishes to exercise his option on the third Friday of April, when the opening level of the index is 759.00, a holder of a short position on this option will be required to pay out the difference of 19.00 to the option holder. Similarly, if a buyer of the April 740.00 put option wishes to exercise his option on the third Friday of April, when the opening level of the index is 721.00, a holder of a short position on this option will be required to pay out the difference of 19.00 to the option holder.

The most attractive feature about options is that they afford the buyer the opportunity to participate in market moves without risking more than what the purchase price. This feature is illustrated in the accompanying profit pay-off diagrams for calls and puts, respectively. Both diagrams presume that the option positions are maintained until they expire, when their values are equal to their **intrinsic value**. For calls, the intrinsic value equals the price of the level of the index minus the strike price; for puts, the intrinsic value is the strike price minus the level of the index.

Payoff Diagram at Expiry
Long Call Option



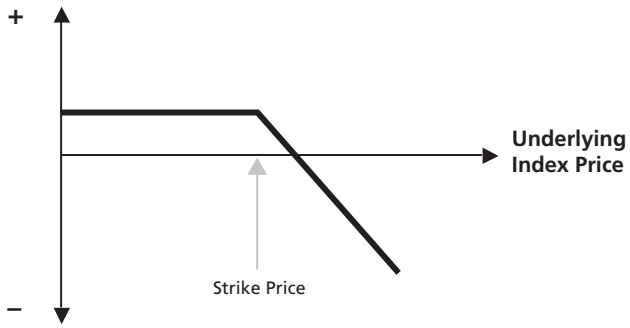
Payoff Diagram at Expiry
Long Put Option



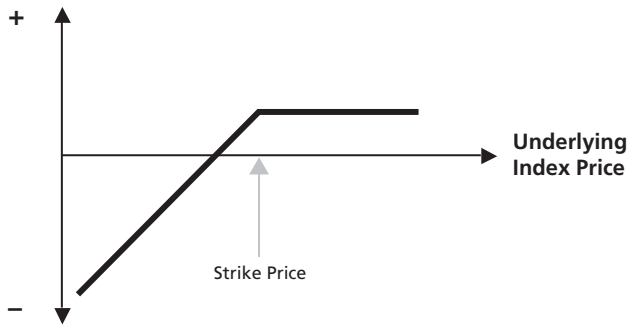
As these diagrams show, call option buyers stand to gain if the market goes up, while put option buyers profit if the market goes down. In either case, however, the market must move sufficiently to compensate the option buyer for the premium he paid out to hold the option.

No discussion of option contracts would be complete without considering the concept of short option positions (i.e. initiating a trade by selling option contracts). While **buying** options offers the opportunity for virtually unlimited gains and limited risk, **selling** options offers the reverse: a limited gain potential equal to the premium received with unlimited risk. The profit/loss payoff outcomes for short option positions are presented in the diagrams below.

Payoff Diagram at Expiry
Short Call Options



Payoff Diagram at Expiry
Short Put Options



Essentially, option sellers wish to make money by selling the option at a high enough price and hoping that the underlying does not move sufficiently to bring the option into the money. An additional consideration for option sellers is that these positions require the posting of margin with their brokers because of the high-risk exposure. As the market fluctuates, the clearing corporation will recalculate the margin requirement, calling for additional collateral from option sellers if its price goes up, but also possibly returning a part of the posted margin if the option's price goes down.

What is an equity index option?

Besides futures contracts, the Montréal Exchange also lists S&P Canada 60 Index options (SXO). At any point in time, a host of option contracts may be listed for trading, given the five expiration months and strike prices in each of these months from which to choose. S&P Canada 60 Index options are European style, meaning that they can only be exercised on their expiration date, the third Friday of the contract month. Listed months include the nearest three months plus the next two months in the quarterly cycle (March, June, September and December).

An annual expiration of December the following year is also listed. This long-term option is appropriate for any option-based hedging or trading strategy. With long-term options, the number of available option expirations is expanded, which allows traders to take positions designed to profit from anticipated changes in implied volatility of options, not only of different strike prices but also of different expiration horizons.

S&P Canada 60 Index options are cash-settled, where the final settlement price is the official opening level of the underlying index on the expiration date (i.e. the same final settlement price procedure as for the S&P Canada 60 Index futures contract).

1. Using options contracts for directional views

Suppose you are bullish about the Canadian stock market. You decide to buy S&P Canada 60 Index call options and you choose an expiration month that covers the time period in which you expect this market appreciation to take place. The choice of strike price reflects a basic trade-off: for the same expiry month, calls with lower strike prices are in-the-money and are more expensive than calls with higher strike prices.

For example, if you expected the market to rise before the middle of April, you would choose a call option that expires in April. Let's consider two such options, one with a strike price of 740.00 and the other with a strike price of 750.00. Suppose the quoted market prices for these two calls are 18.00 and 14.00, respectively. Each option contract will cost C$100 (the multiplier) times the posted premium, therefore the 18.00 index point price translates into a cash requirement of C$1,800 and the 14.00 index price translates to C$1,400.

Which of these two alternatives is the better choice depends on where the market goes and how fast. Ultimately, however, we can identify the break-even prices for the two options. For the 740-strike call, the index has to rise above a level of 758.00 by the option's expiration date in order to be profitable, whereas the break-even level for the 750-strike option is 764.00. In both cases, we arrive at the break-even level by adding the option's premium to the strike price.[10]

[10] In assessing the break-even prices for a put option, the option premium is subtracted from the strike price.

Call buyers should understand that their potential loss is limited to the option premium and that this loss would in fact be realized if the index level were below the strike price of the option at expiration. Alternatively, given the same holding period, if the level of the index were to rise above the strike price, the profit would be equal to the final intrinsic value of the option (i.e. the difference between the index level and the strike price), less the original premium. Hypothetical results for these two options are shown in Table 2.

Table 2: Operations results on calls

	Call 740	Call 750
Initial premium (index points)	18.00	14.00
Initial premium (C$)	1,800.00	1,400.00
Break-even price	758.00	764.00
Final index value	765.00	765.00
Option price at expiry (index points)	25.00	15.00
Option price at expiry (C$)	2,500.00	1,500.00
Profit (index points)	7.00	1.00
Profit (C$)	700.00	100.00

It should be clear that the trader who had a bearish view (i.e. that the stock market would decline) would have bought put options, rather than calls. In this case, the strategy would be profitable if the index would drop below the put's strike price, with limited risk if equity prices were to rise.

2. Using options contracts for hedging

Equity portfolio managers who are bearish may want to consider the strategy of buying put options as a form of insurance. The idea is straightforward: for the price of the premium, the investor can protect his portfolio against the risk associated with a drop in the S&P/TSX 60 Index below the level of the strike price. If the index remains above this strike price, however, the exposure to the market remains intact, but the premium paid for the put will not be recovered.

When employing this strategy, the number of option contracts must be determined. To achieve this objective, the hedger must base the size of the option position on the size of the exposure, using the following formula:

$$N = \frac{V \times \text{ßeta}}{\text{S\&P/TSX 60} \times \text{C\$100}}$$

Where **N** is the required number of options contracts;
V is the value of the equity position that you want to hedge;
ßeta is the sensitivity measure of the portfolio in relation to the index;
S&P/TSX 60 is the level of the S&P/TSX 60 Index; and
C$100 is the multiplier for the options contract.

The choice of the strike price is determined by the point from which protection is desired. Suppose, for example that you were prepared to assume the risk of a 5% decline in the value of the portfolio, where your portfolio exhibited a beta of 1.2 (that is, if the S&P/TSX 60 Index were to change by 10%, your portfolio would be expected to change by 12%). Under these conditions, a 5% decline in your portfolio's value would be associated with a 4.17% decline of the S&P/TSX 60 Index (5%/1.2). Assuming a current index value of 730.00, the appropriate break-even price for the put option would be 730.00 x (100% – 4.17%) = 699.56. For the sake of this example, assume the 720-strike put could be purchased for a price of 15.25, generating a break-even price equal to 704.75. Table 3 illustrates the performance of this hedge assuming a market decline of 20%.

Table 3: Hedging a portfolio with a long put, where beta = 1.2

Starting conditions

S&P/TSX 60 Index	730.00
Portfolio value (C$)	1,000,000.00
Portfolio beta	1.2
720-strike put	16 options
Option price (index points)	15.25

Ending conditions (Market depreciates 20%)

S&P/TSX 60 Index	584.00
Put value (720 – 584)	136.00
Loss in portfolio (C$) (20% x 1.2)	(240,000.00)
Portfolio value (C$)	760,000.00
Profit from the hedge (C$) [(136.00 – 15.25) x 100 x 16]	193,200.00
Combined outcome (240,000 – 193,200) (C$)	(46,800.00)
Portfolio + Hedge, combined value (C$)	953,200.00

Given this hedging strategy, we can see that the hedge in place has allowed us to limit the loss at 4.9% unlike the underlying market that dropped by 20%.

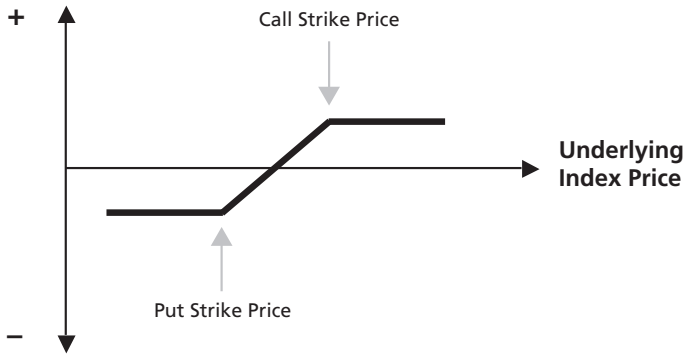
3. Using options contracts for hedging — collars

For many investors who seek price protection for an equity position, the up-front cost of a put option may seem to be expensive. For these investors, a **collar** offers an interesting alternative. A collar entails the purchase of a put option with a simultaneous sale of a call option with the same expiry for a total cost near zero. This is possible by choosing call and put strike prices that are more or less equidistant of the spot value of the index when the transaction was initiated.

Consider the case where the index is at a price of 730.00 and assume the collar is constructed with a long 720-put and a short 740-call. Assume, further, that the option positions are maintained until the options' expiration. The premium received from the sale of the call will partially finance the premium paid for the purchase of the put. The put option will be in-the-money if the level of the index falls below 720.00. If this happens, the call option will expire worthless. In the opposite market scenario, with the level of the index ending up above 740.00, the call will end up being in-the-money while the put will end up worthless. Thus, the loss incurred by the call option sold will limit the portfolio's potential profit in the event the index is above 740.00.

The collar will thus have the effect of limiting the market exposure to a range bounded by the strike price of the put at the lower end and the strike price of the call at the higher end (as shown in the diagram below). By the choice of strike prices, investors can decide how much risk they want to take in the event of market depreciation, based on the potential returns.

Collar



What are options on the iShares CDN S&P/TSX 60 Index Fund?

For individual investors, the Montréal Exchange offers options on the iShares CDN S&P/TSX 60 Fund. This product (XIU) has been tailored to suit the individual investor's needs since the contract size is 10 times smaller than the S&P Canada 60 Index options (SXO). Therefore, holding one iShares unit is equivalent to owning one tenth (1/10) of the S&P/TSX 60 Index value.

These options are traded in the same way as stock options and, unlike the SXO option, the exercise of these options will result in the delivery of the units.

Sectorial iShares options are also listed for the following Canadian economic sectors: information technology, finance, materials, energy and gold.

1. Using options contracts for hedging

While buying iShares units allows the individual investor to hold a diversified stock portfolio in his account, these units are still subject to the fluctuations of the Canadian stock market.

The average person doesn't think twice in buying insurance for his most valuable possessions (his home, car, boat, etc.). Life and invalidity insurance is even purchased to ensure that one's loved ones will be cared for should the worst happen. Despite this, most people never think of buying insurance on what could be their most important asset: their life savings!

Purchasing put options will act as an insurance policy for your savings against any downturn in the market. While you would lose money in your portfolio if stock prices fell, the puts you hold will gain value. The following example illustrates this.

Investor A bought 1,000 iShares on June 1 at $62 each. On January 22, these units are worth $73. Investor A wishes to protect his gains against a downturn in the market by buying XIU puts. The options available to him are the following:

Strike Price	June Puts	September Puts
69	C$1.20	C$2.10
73	C$2.40	C$3.15
77	C$4.55	C$5.20

He decides to buy 10 September 69 XIU puts. He does not buy the September 73 puts because they are more expensive and the 69 puts will protect quite well in the case of a major correction.

These 10 puts cost him C$2,100 (C$2.10 x 100 iShares units x 10 options contracts). Let's see what happens if the market does indeed experience a correction before September.

On September 21 (the September contract's last trading date):

The iShares units are now trading at C$55. The XIU September 69 puts can be sold at their intrinsic value of C$14.00 for a profit of C$11,900 [(C$14 x 100 iShares units) x 10 contracts – C$2,100 (purchase price)] on the option trade. While Investor A lost C$18,000 on his units from January 22 to September 21, the insurance policy he purchased in the form of puts covered his portfolio in part against a decline in the market. His loss is limited to C$6,100 (C$18,000 – C$11,900) instead of C$18,000.

However, Investor A could have decided to exercise his options and deliver the iShares units instead of reselling the options.

Had the market not declined and the price of the iShares units had risen to C$85 for example, Investor A's iShares units would be worth C$12,000 more [(85 – 73) x 1,000]. In this case, the insurance policy, the XIU September 69 puts, would expire worthless and Investor A will have only lost the purchase price of the puts, C$2,100, for a net profit of C$9,900 (C$12,000 – C$2,100).

2. Using options contracts for directional views

An investor expecting a rise in the overall Canadian stock market can buy iShares units in order to profit from such a rise. He can also purchase XIU calls which would also profit from a bull market and which are a less expensive alternative. For example:

On August 1, Investor B believes that the Canadian stock market is poised for an upswing within the next few months. He evaluates two possibilities: a) buy 500 iShares units at C$67; or b) buy 5 XIU December 72 calls at C$1.50. Let's see how each of these alternatives plays out under two different scenarios: a bullish one and a bearish one.

Scenario #1: The price of the iShares units rises to C$80

	Strategies	
	Buying iShares units	**Buying XIU calls**
August 1: (iShares units @ C$67)	Buy 500 iShares units @ C$67 = (C$33,500)	Buy 5 XIU December 72 calls @ C$1.50 = (C$750)
December 1: (iShares units @ C$80)	Sell 500 iShares units @ C$80 = C$40,000	Sell 5 XIU December 72 calls @ C$8.50 = C$4,250
Results:	1) Initial outlay: C$33,500 2) Gain: C$6,500 3) Yield: 19.40%*	1) Initial outlay: C$750 2) Gain: C$4,250 3) Yield: 567%

* This calculation does not take into account that the purchase was done on margins with the broker.

Scenario #2: The price of the iShares units falls to C$50

	Strategies	
	Buying iShares units	**Buying XIU calls**
August 1: (iShares units @ C$67)	Buy 500 iShares units @ C$67 = (C$33,500)	Buy 5 XIU December 72 calls @ C$1.50 = (C$750)
December 1: (iShares units @ C$50)	Sell 500 iShares units @ C$50 = (C$25,000)	Cannot sell the calls (they are worthless)
Results:	1) Initial outlay: C$33,500 2) Loss: (C$8,500) 3) Yield: (25.37%)*	1) Initial outlay: C$750 2) Loss: (C$750) 3) Yield: (100%)

* This calculation does not take into account that the purchase was done on margins with the broker.

As can be seen in these two scenarios, Investor B will have a higher yield on his investment if he buys calls and the market rises. Furthermore, if the market drops, Investor B's maximum loss if he buys calls is the initial premium paid.

XIU options allow speculators on the Canadian stock market a greater breadth of opportunities with a limited and known amount of risk.

Conclusion

To broaden the investment possibilities relating to Canadian stock portfolios, the Montréal Exchange has introduced futures and options contracts on index and sectorial indices.

These contracts on Canadian economic sectors are very efficient tools in risk management and allow asset allocation, especially for short-term portfolio adjustments.

These contracts can also be used to hedge the profit realized on an investment or to freeze a loss incurred. In the portfolio management context, they can serve to hedge a portfolio from the effect of fluctuations in stocks of companies operating in an economic sector.

For institutional investors with very low transactions costs, futures contracts allow arbitrage or quasi-arbitrage strategies intended to restore a balance between the spot market of the underlying asset and the futures market (or within a futures market, between expiration dates), or between the various futures contracts available.

Lastly, these contracts enable investors to profit from short-term fluctuations in the stock market. This type of operation carries important risks, but it generates important potential profit; only well-informed investors should consider it.

Role of the Canadian Derivatives Clearing Corporation (CDCC)

The CDCC is the issuer, clearinghouse and guarantor of interest rate, equity and index derivative contracts traded on the Montréal Exchange. It also offers clearing services to other exchanges and partners. Established in 1975, CDCC is a for-profit company owned by Bourse de Montréal Inc. CDCC requires each member to maintain margin deposits with the clearinghouse in order to cover the market risk associated with their positions. The assessment of this risk is based on a set of well-defined criteria established by the clearinghouse. Margins are collected daily or more frequently during periods of market volatility.

If a buyer wants to exercise his option, he must contact the CDCC through his broker, not the initial buyer of the option. The CDCC ensures that the stocks are delivered in exchange for the final payment or that the position is settled in cash.

Because only one organization, the CDCC, looks after clearing, it is not necessary to evaluate the risk related to whether the parties are solvent. Thanks to the standards established by the CDCC with regard to having sufficient equity and complying with the daily coverage requirements, the contracts traded are always based on solid guarantees. Furthermore, in terms of clearing and regulations, the CDCC ensures that the parties act in a disciplined manner when they trade and take a position.

Finally, the CDCC ensures that option holders can take and dispose of a position. Thus, everyone has the opportunity to trade options on a liquid, transparent market.

Appendix 1

Contract specifications for S&P Canada 60 Index Futures

Underlying	The S&P/TSX 60 is a capitalization-weighted index of the 60 largest companies in Canada, which have the most liquid stocks.
Contract Size	C$200 times the futures value.
Contract Months	March, June, September and December.
Price Quotation	The contract is quoted in index points, expressed to two decimals.
Minimum Price Fluctuation	• 0.10 index points for outright positions • 0.01 index points for calendar spreads
Last Trading Day	The trading day prior to the Final Settlement Day.
Final Settlement Day	The 3rd Friday of the contract month, providing it be a business day; if not, the 1st preceding business day.
Contract Type	Cash settlement. The final settlement price is the Official Opening Level of the underlying index to the Final Settlement Day.
Reporting Limit	1,000 net long or short in all contract months combined.
Position Limits	Information on Position Limits can be obtained from the Bourse as they are subject to periodic changes.
Minimum Margin Requirements	Information on Minimum Margin Requirements can be obtained from the Bourse as they are subject to periodic changes.
Price Limits	A trading halt will be invoked in conjunction with the triggering of "circuit breaker" in the underlying stocks.
Trading Hours	9:30 a.m. to 4:15 p.m. (Montréal time)
Clearing Corporation	Canadian Derivatives Clearing Corporation (CDCC)
Ticker Symbol	SXF

Appendix 2

Contract specifications for sectorial index futures

Underlying	The designated S&P/TSX Sector Index: • S&P/TSX Capped Information Technology Index • S&P/TSX Capped Energy Index • S&P/TSX Capped Financials Index • S&P/TSX Global Gold Index
Contract Size	• SXH (Information technology) > C$500 x the futures value • SXY (Energy) > C$200 x the futures value • SXB (Financials) > C$200 x the futures value • SXA (Gold) > C$200 x the futures value
Contract Months	March, June, September and December.
Price Quotation	Quoted in index points, expressed to two decimals.
Minimum Price Fluctuation	• 0.05 index points for the S&P/TSX Capped Information Technology Index • 0.10 index points for the S&P/TSX Capped Energy Index • 0.10 index points for the S&P/TSX Capped Financials Index • 0.10 index points for the S&P/TSX Global Gold Index
Last Trading Day	The trading day prior to the Final Settlement Day.
Final Settlement Day	The 3rd Friday of the contract month, providing it be a business day; if not, the 1st preceding business day.
Contract Type	Cash settlement. The final settlement price is the Official Opening Level of the underlying sectorial index on the Final Settlement Day.
Reporting Level	500 net long or short in all contract months combined.
Position Limits	Information on Position Limits can be obtained from the Bourse as they are subject to periodic changes.
Minimum Margin Requirements	Information on Minimum Margin Requirements can be obtained from the Bourse as they are subject to periodic changes.
Price Limits	A trading halt will be invoked in conjunction with the triggering of "circuit breaker" in the underlying stocks.
Trading Hours	9:30 a.m. to 4:15 p.m. (Montréal time)
Clearing Corporation	Canadian Derivatives Clearing Corporation (CDCC)
Ticker Symbols	SXA — Gold SXB — Financials SXY — Energy SXH — Information Technology

Appendix 3

Contract specifications for S&P Canada 60 Index Options

Underlying	The S&P/TSX 60 is a capitalization-weighted index of the 60 largest companies in Canada, which have the most liquid stocks.
Multiplier	C$100 per S&P/TSX 60 Index point.
Contract Months	The nearest three months plus the next two months in the designated quarterly March, June, September and December cycle. Annual expiry of December (long term).
Minimum Price Fluctuation	• 0.01 index points equivalent to C$1 per contract for premiums of less than 0.10 index points; and • 0.05 index points equivalent to C$5 per contract for premiums of 0.10 index points and up.
Strike Prices	• Set at a minimum of 2.5 index points. • Set at a minimum of 5 index points (long term options).
Contract Type	European style.
Last Trading Day	The trading day prior to the expiration Day.
Expiration Day	The 3rd Friday of the contract month, providing it be a business day; if not, the 1st preceding business day.
Settlement upon Exercise	Cash settlement. The final settlement price is the Official Opening Level of the underlying index on the expiration day.
Reporting Limit	1,500 contracts on the same side of the market in all options contract months combined.
Position Limits	Information on Position Limits can be obtained from the Bourse as they are subject to periodic changes.
Minimum Margin Requirements	Information on Minimum Margin Requirements can be obtained from the Bourse as they are subject to periodic changes.
Price Limits	A trading halt will be invoked in conjunction with the triggering of "circuit breaker" in the underlying stocks.
Trading Hours	9:30 a.m. to 4:15 p.m. (Montréal time)
Clearing Corporation	Canadian Derivatives Clearing Corporation (CDCC)
Ticker Symbol	SXO

Appendix 4

Contract specifications for options on the iShares CDN S&P/TSX 60 Fund

Underlying	Units of the iShares CDN S&P/TSX 60 Fund. Barclays Global Investors Canada Limited is the trustee and the manager of the units.
Trading Unit	One option contract represents 100 iShares units.
Contract Months	The nearest three months plus the next two months in the designated quarterly cycle March, June, September and December. Annual expiry of March (long-term options)
Last Trading Day	3rd Friday of the contract month, providing it be a business day; if not, the 1st preceding business day.
Expiration	The Saturday following the last trading day of the contract month.
Contract Type	American style. Exercise is carried out via the Canadian Derivatives Clearing Corporation (CDCC) and delivery is carried out via The Canadian Depository for Securities Limited (CDS), on the 3rd business day following the exercise date.
Minimum Price Fluctuation	• C$0.01 for premiums of less than C$0.10; and • C$0.05 for premiums of C$0.10 and up.
Reporting Limit	500 contracts on the same side of the market in all contract months combined.
Strike Prices	• Set at a minimum of C$0.50 intervals. • Set at a minimum of C$1.00 intervals (long-term options).
Position Limits	Information on Position Limits can be obtained from the Bourse as they are subject to periodical changes.
Minimum Margin Requirements	Information on Minimum Margin Requirements can be obtained from the Bourse as they are subject to periodic changes.
Price Limits	A trading halt will be invoked in conjunction with the triggering of "circuit breaker" in the underlying stocks.
Trading Hours	9:30 a.m. to 4:00 p.m. (Montréal time)
Clearing Corporation	Canadian Clearing Derivatives Corporation (CDCC)
Ticker Symbol	XIU

Appendix 5

Contract specifications for options on iShares Sector Index Funds

Underlying	100 iShares of one of the following Funds: XEG, XEX > CDN S&P/TSX Capped Energy Index Fund XFN > CDN S&P/TSX Capped Financials Index Fund XGD, XGL > CDN S&P/TSX Capped Gold Index Fund XIT > CDN S&P/TSX Capped Information Technology Index Fund XMA > CDN S&P/TSX Capped Materials Index Fund
Contract Months	The nearest three months plus the next two months in the designated quarterly cycle March, June, September and December. Annual expiry of March (long-term options)
Last Trading Day	3rd Friday of the contract month, providing it be a business day; if not, the 1st preceding business day.
Expiration	The Saturday following the last trading day of the contract month.
Contract Type	American style. Exercise is via the Canadian Derivatives Clearing Corporation (CDCC). Options shall be exercised by clearing approved participants in accordance with the Rules and General Conditions of the designated Clearing Corporation. Options may be exercised only in a unit of trading or in an integral multiple thereof. Delivery is via The Canadian Depository for Securities Limited (CDS).
Minimum Price Fluctuation	• C$0.01 for premiums of less than C$0.10; and • C$0.05 for premiums of C$0.10 and up.
Reporting Limit	500 contracts on the same side of the market in all contract months combined.
Strike Prices	Set at a minimum of C$0.50 intervals.
Position Limits	Information on Position Limits can be obtained from the Bourse as they are subject to periodic changes.
Minimum Margin Requirements	Information on Minimum Margin Requirements can be obtained from the Bourse as they are subject to periodic changes.
Price Limits	A trading halt will be invoked in conjunction with the triggering of "circuit breaker" in the underlying stocks.
Trading Hours	9:30 a.m. to 4:00 p.m. (Montréal time)
Clearing Corporation	Canadian Clearing Derivatives Corporation (CDCC)
Ticker Symbols	XEG, XEX — Energy XFN — Financials XGD, XGL — Gold XIT — Information Technology XMA — Materials

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