CHARTERED BUSINESS VALUATORS INSTITUTE (CANADA) WEBINAR CBV MATTERS DLOM ABBOTT CALCULATOR DECEMBER 4, 2025

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MARGRABE EXCHANGE OPTIONS CALCULATOR FOR DISCOUNTS FOR LACK OF LIQUIDITY AND MARKETABILITY

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LIQUIDITY

- Liquidity is an asset specific attribute, often assumed in theoretical models, but lacking in the real world.
- Liquidity is a 'slippery and elusive' concept comprising of four dimensions of liquidity as *immediacy* of execution, *depth,* or the ability to execute buy or sell orders without a significant impact on price, *width* or availability of counterparty traders, and *resiliency* or the speed of a return to 'normal' liquidity following an adverse liquidity shock.

Calendar year 2023	Observations	Mean	Median
NASDAQ Number of daily trades	1026687	7506.67	929
Average Shares Traded per trade	1014857	279.78	91.09
Daily Turnover	1026670	2.68%	0.42%
Trading Cost	1026650	1.18%	0.29%

- Kyle, A. S. "Continuous auctions and insider trading", Econometrica, 52(6):1315–1335, 1985.

MARKETABILITY

- Marketability refers to *capability* and *ease* of transferring ownership from the current holder of the asset.
- *Marketability* is holder specific, determined by the investor-specific trading restrictions.
- Prevailing regulatory restraints determine the degree of marketability. For example, Safe harbor rule 144 currently places an initial six-month restriction period before the stocks can be offered to the public.
- In addition, affiliates (officers and 10% or larger holders) of the firm are subject to continuing trading volume restrictions after this six-month period. Therefore, suffering a larger impairment in value as compared to non-affiliates that are not subject to such restrictions.
- Restricted stock, which cannot be traded in the open market until the restriction is removed illustrates the impact of *lack of marketability*.

WHY IS DLOM APPLIED

- The assumptions of marketability and liquidity are baked into the valuation estimates. In case these assumptions of marketability and/ or liquidity are not tenable, this estimated value needs to be modified to reflect the relative lack of liquidity and/or marketability. It is frequently recognized that markets are subject to inefficiencies and the impact of these inefficiencies needs to be factored in when valuing private companies and fractional interests.
- Applying a discount for lack of marketability to the freely traded publicly traded equivalent value factors in the impact of these inefficiencies.

RESTRICTED STOCK

- The restricted stock offered by a registered public exchange traded company is identical in all respects to the unrestricted stock issued by the same company except the holders' inability to sell it in the public markets.
- Acquiring a restricted stock is equivalent to entering a forward contract to deliver the restricted stock and receiving the unrestricted stock at the end of the period of restriction.
- The holder of a restricted stock, at the end of the restriction period, receives an equivalent unrestricted stock, *the value of which is unknown at the time of initial acquisition of the restricted stock*.
- Holder of restricted stock can exercise its voting rights, same as holder of the unrestricted stock.
- Holder of restricted stock is eligible to receive any dividends/distributions made to the unrestricted stock.

APPROACHES TO DLOM ESTIMATION

- Quoting “Studies”
- (Delisting Studies, Pre-IPO studies)
- Restricted Stock Studies for Private Placements of Restricted Stock
- Option Based Models

MARGRABE EXCHANGE OPTION VS. BLACK SCHOLES PUT OPTION

- Margrabe Exchange Option
- Option to exchange the restricted share for an unrestricted share at the end of the period of restriction.
- The option will always be exercised, as the restricted stock turns into equivalent unrestricted stock at the end of the restriction period.
- No Price protection, price of the unrestricted stock at exchange is unknown at the time the restricted stock is acquired.

- Black Scholes Put Option
- Option to exchange the restricted stock for a fixed known price at the end of the period of restriction.
- The put option will not be exercised if the price of the unrestricted stock is higher than the exercise price for the put option.
- Complete price protection, exercise price of the put option is known in advance.

DISCOUNTS FOR LACK OF LIQUIDITY AND MARKETABILITY

- Basic Assumptions.
- 1. All assets have a positive value, an asset, restricted or unrestricted cannot have a negative value.
- $V_0 \geq 0 \quad ; R_0 \geq 0$ (1)
- 2. Liquid asset is valued higher than the illiquid asset.
- $V_0 \geq R_0 \geq 0$

  (2)
- 3. A contract 'M' exists such that the payout for holding the illiquid asset and the payout from holding this contract together are always equal to the payout from holding the liquid asset.
- $R_0 + M = V_0$ in the no-arbitrage equilibrium $M = (V_0 - R_0)$. (3)

DISCOUNTS CAN NEVER BE GREATER THAN 100%

- Value of this contract ‘M’ is always less than that of the liquid asset; otherwise, the illiquid asset has a negative value.
- $V_0 \geq (V_0 - R_0) \geq 0$ (4)
- Dividing through by V_0
- $V_0 / V_0 \geq (V_0 - R_0) / V_0 \geq 0$
- $1 \geq \mathbf{1 - (R_0 / V_0)} \geq 0$ (5)
- The discount from the free liquid value will always lie between zero and 100%, and this discount can never be greater than 100%.

MARGRABE EXCHANGE OPTION (MEO)

- Calculating the exchange ratio (R) in a Margrabe framework
- R $= (2) * N\left(\frac{\sigma\sqrt{T}}{2}\right)$
- One Unrestricted share is worth $(2) * N\left(\frac{\sigma\sqrt{T}}{2}\right)$ restricted shares
- Discount applicable as a percentage of the Unrestricted share price is
- 1-(1/R)
- This is the discount when all ***public*** information is available to both buyer and seller, and no private information is involved.

PRIVATE INFORMATION EXTENSIONS
ASIAN AVERAGE EXCHANGE OPTION (AAEO)

- All Public and Private information is available to both the buyer and the seller.
- The volatility of returns (σ) is replaced by the volatility of average prices (v)
- Where v is estimated as
- $v = \sqrt{\frac{\sigma^2 T + \ln[2\left(e^{\sigma^2 T} - \sigma^2 T - 1\right)] - 2\ln[e^{\sigma^2 T} - 1]}{T}}$
- To yield the exchange ratio
- $R = \left[2N\left(\frac{v\sqrt{T}}{2}\right)\right]$
- As above the discount from the unrestricted stock price is 1-(1/R) applicable when all ***public and private*** information is available to both the buyer and the seller.

SELLER HAS PRIVATE AND PUBLIC INFORMATION BUYER HAS ONLY PUBLIC INFORMATION LOOK BACK EXCHANGE OPTION (LBEO)

- Information Asymmetry
- Buyer prices defensively, seeking maximum discount, the exchange ratio is the maxima achievable during the time of restriction
- $MAX \quad (R) = \quad \left[\left(2 + \frac{\sigma^2 T}{2}\right) * N\left(\frac{\sigma\sqrt{T}}{2}\right) + SQRT\left(\frac{\sigma^2 T}{2\pi}\right) * e^{-\frac{\sigma^2 T}{8}}\right]$
- As above the discount from the unrestricted stock price is 1-(1/R) applicable when all ***public and private*** information is available to the seller and only the ***public*** information is available to the buyer.

USING REAL MARKET DATA

- Introduction of XBRL protocol for SEC submissions started in 2004 and was fully implemented by January 2005.
- This has helped to break the stranglehold of major market data providers and access to this data has expanded.
- This is particularly important as the market liquidity and volatility conditions change over time and need to synchronize with the period of valuation.

ENDING DLOM INEQUALITY

Data cost and access is an impediment for small and medium size valuation firms.

Data sets are large, expensive, and require high levels of resources to acquire and maintain.

You have access to 36 Million plus daily data records for all public exchange traded securities covering Years 2005-2024 .

The data are organized across 240 months with2400 size decile portfolios, 17241 Two-Digit SIC code portfolios, and 135,814 portfolios organized across Size Deciles and Two-Digit SIC codes.

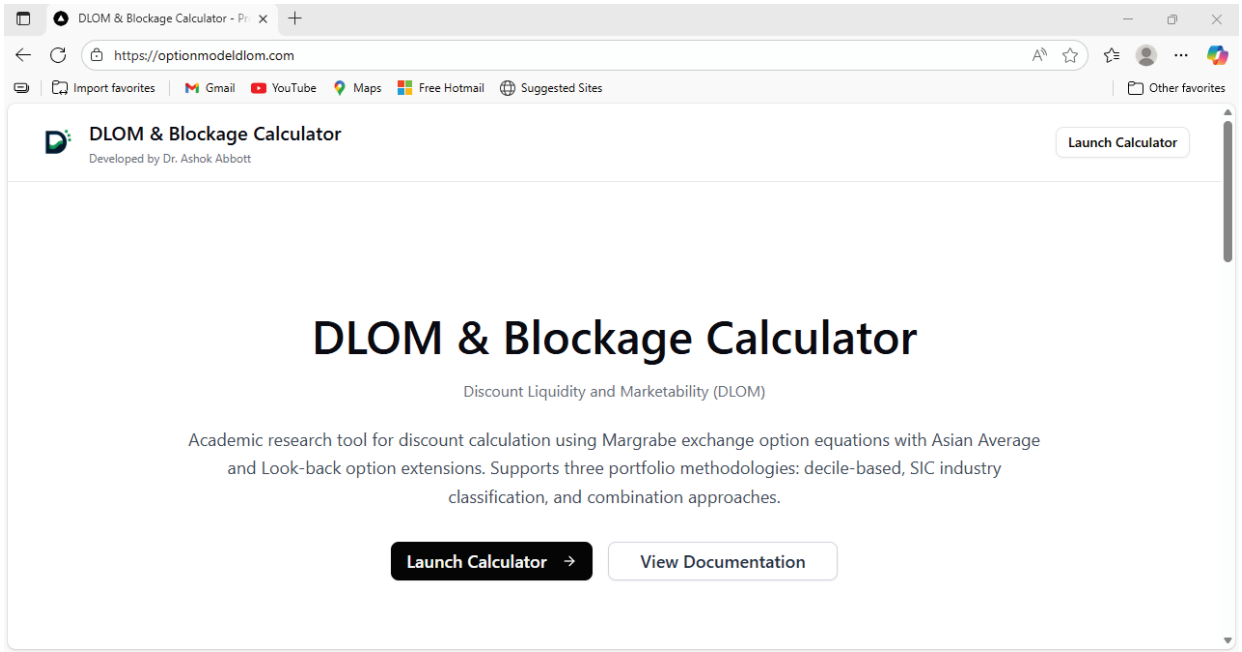
ESTIMATING BLOCKAGE(DLOL) AND LACK OF MARKETABILITY (DLOM) DISCOUNTS

Only Two inputs, the lognormal returns volatility and the expected median half-life (volume weighted liquidation period) are needed to estimate the applicable Blockage and DLOM discounts.

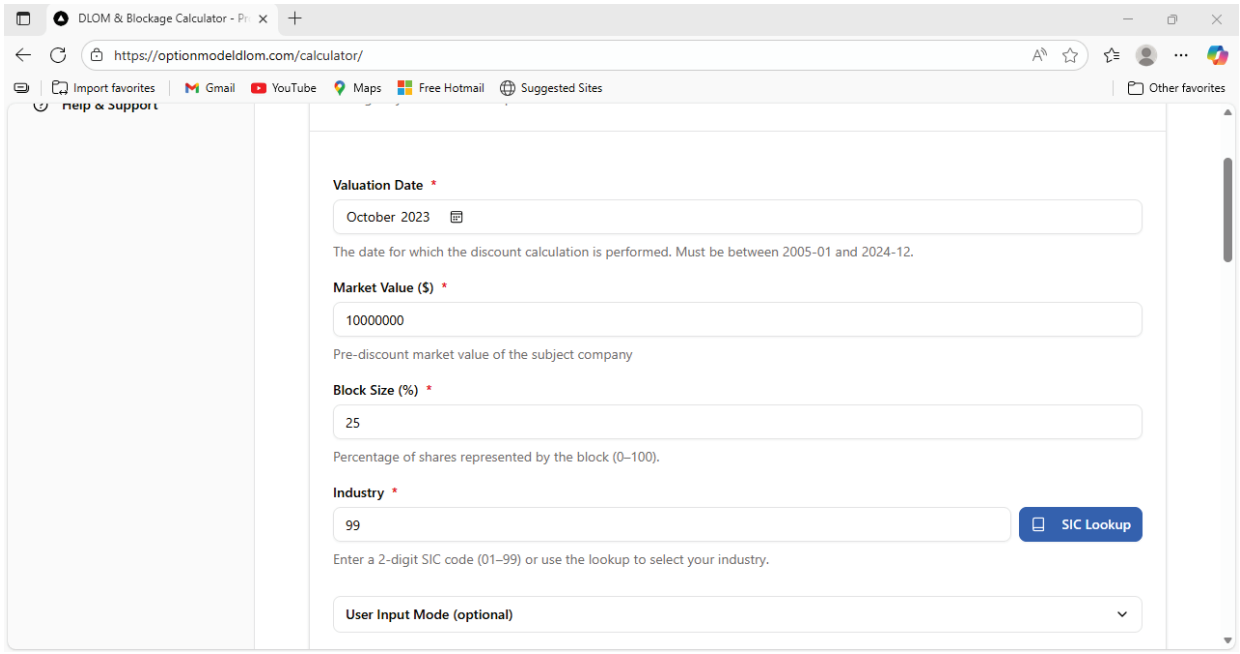
SHARED, CLOUD-NATIVE PLATFORM

- **A unified, shared, cloud-native DLOM platform can deliver an effective solution for these dilemmas while providing:**
- **Access to robust datasets without infrastructure costs.**
- **Collaboration tools for valuation, tax, audit, and legal teams.**
- **Compliance-ready outputs aligned with USPAP, AICPA, ASC 820, IFRS 13.**

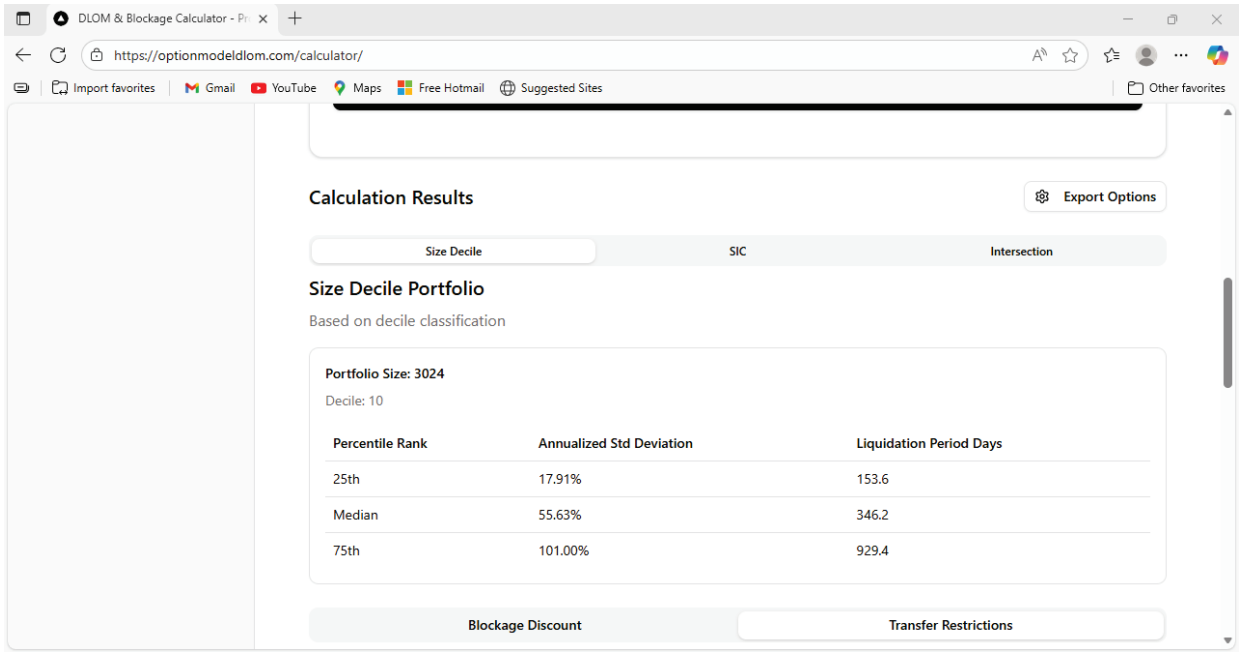
ACCESS THE CALCULATOR AT OPTIONMODELDLOM.COM



LAUNCH CALCULATOR
ADD INPUTS AND PRESS CALCULATE DISCOUNT

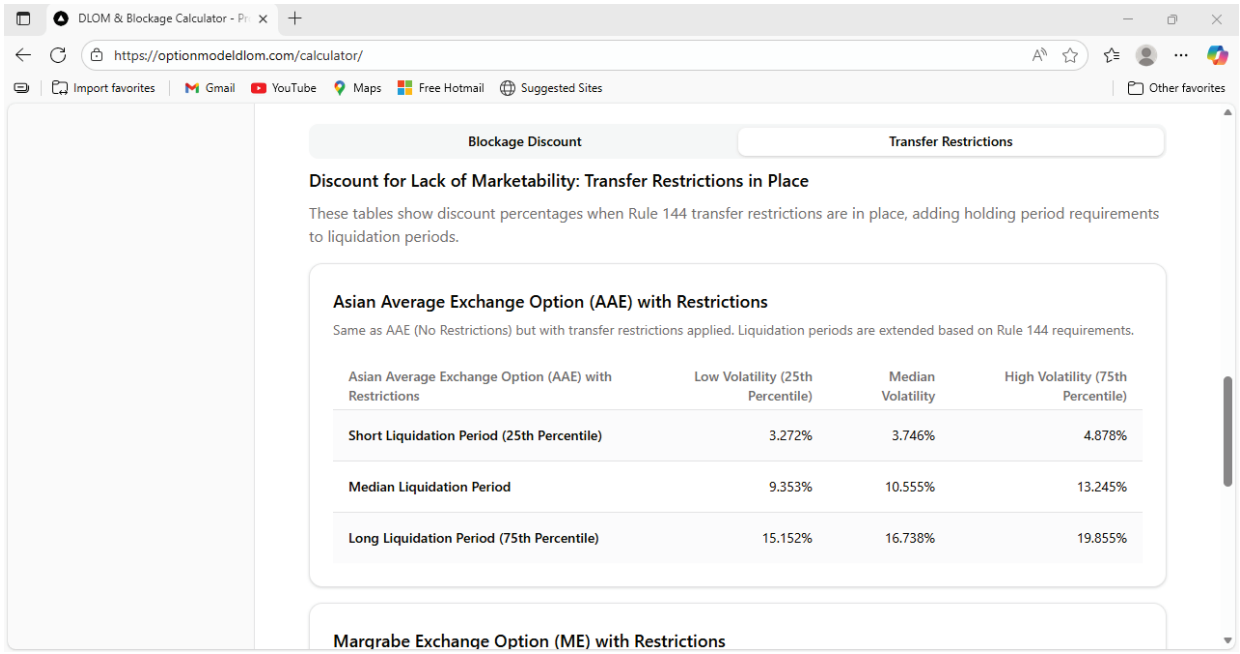


PEER GROUP PARAMETERS DISPLAYED



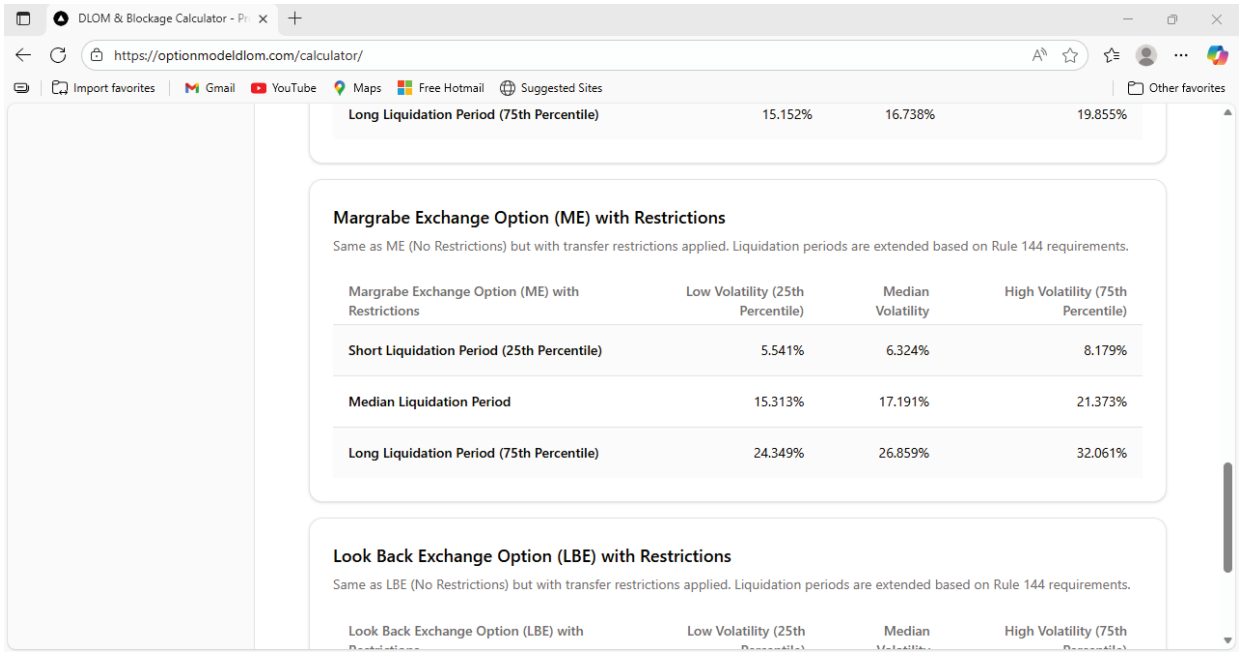
ASIAN AVERAGE OPTION

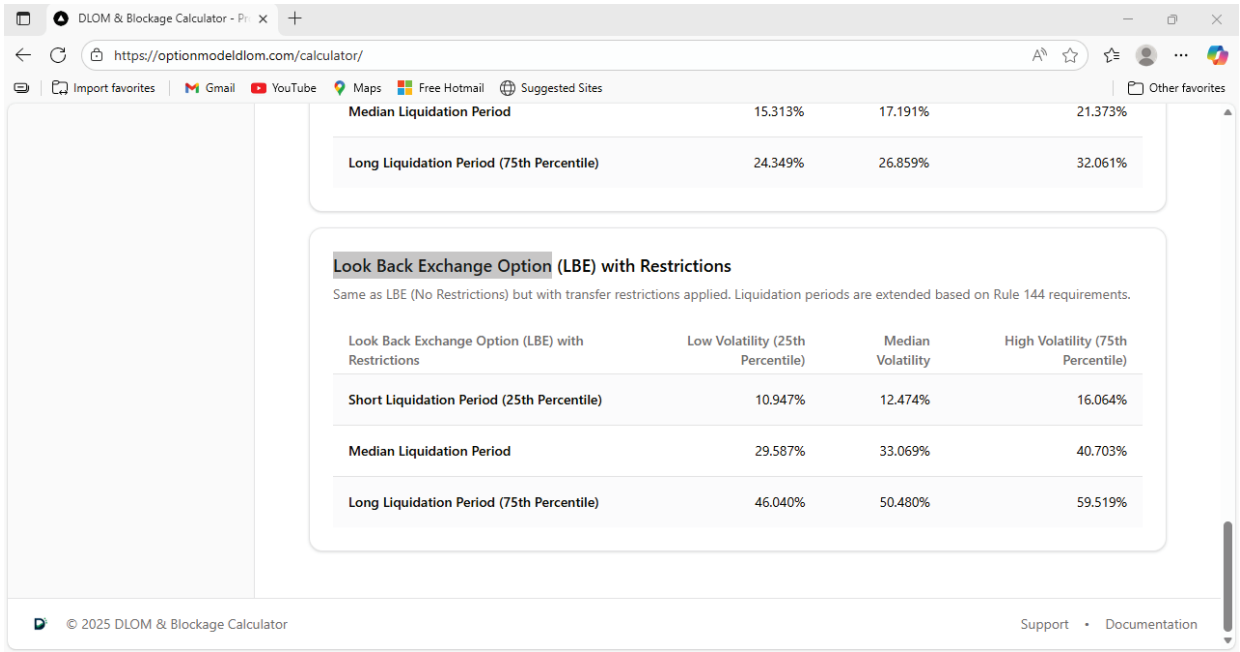
PAYOUT AT MATURITY = ARITHMETIC AVERAGE PRICE ACHIEVED FOR ONE UNRESTRICTED SHARE DURING THE LIFE OF THE OPTION.



MARGRABE EXCHANGE OPTION.

PAYOUT AT MATURITY = ONE UNRESTRICTED SHARE



LOOK BACK EXCHANGE OPTION

PAYOUT AT MATURITY = HIGHEST PRICE ACHIEVED FOR ONE UNRESTRICTED SHARE DURING THE LIFE OF THE OPTION.