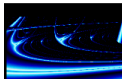


# DERIVATIVES on ETFs

Dr A. A. Kotzé  
Financial Chaos Theory



**Sagittarius A\***: supermassive black hole at the Milky Way's center



Niels Bohr  
and  
Albert Einstein



***Before I came here I was confused about the subject. Having listened to your lecture I am still confused. But on a higher level.***

Enrico Fermi (1901-1954)

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## What's in the 1997 Nobel prize?



Myron Scholes (1941 - )



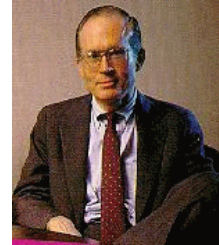
Robert Merton (1944 - )

Along the way, it changed the way investors and others place a value on **risk**, giving rise to the field of **risk management**, the increased marketing of derivatives, and widespread changes in the valuation of corporate liabilities.

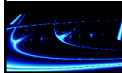
The theory "is absolutely crucial to the valuation of anything from a company to property rights". In my view, **financial economics deals with four main phenomena:**

**time, uncertainty, options and information.**

William F. Sharp



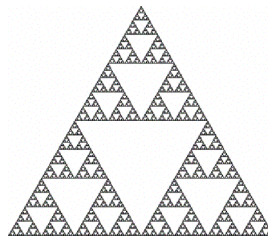
Fischer Black (1938 - 1995)



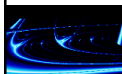
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## Drivers of the markets

- Only two emotions drive the market – **GREED** and **FEAR**



- Two types of traders – **SPECULATORS** and **HEDGERS**



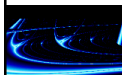
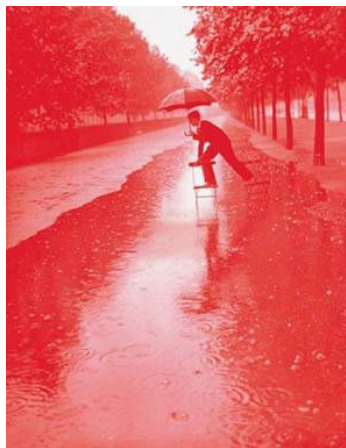
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## DERIVATIVES: why?

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Derivatives expanded the universe of instruments available for trading and hedging

- Speculators use derivatives to expose portfolios to some market risk
- Hedgers use derivatives to reduce the market risk they are exposed to



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## Hedging

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- Transfer risk
- Risks more precisely tailored to risk preferences and tolerances
- Those willing to bear risk must be compensated
- Most transactions still for speculating and not hedging
- Speculators provide liquidity

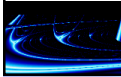


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## Linear derivatives

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- A forward/futures contract is a linear derivative
- Its payoff function is a linear function
- Every one tick movement translates directly into a specific Rand value
- OTC: forwards
- Safex (exchange): futures contract



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## Forwards/Futures

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A person holding a futures contract has the right to buy a certain underlying asset at a future date at a pre-determined price

Payoff

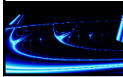
$$V(T) = \phi(S - K)$$



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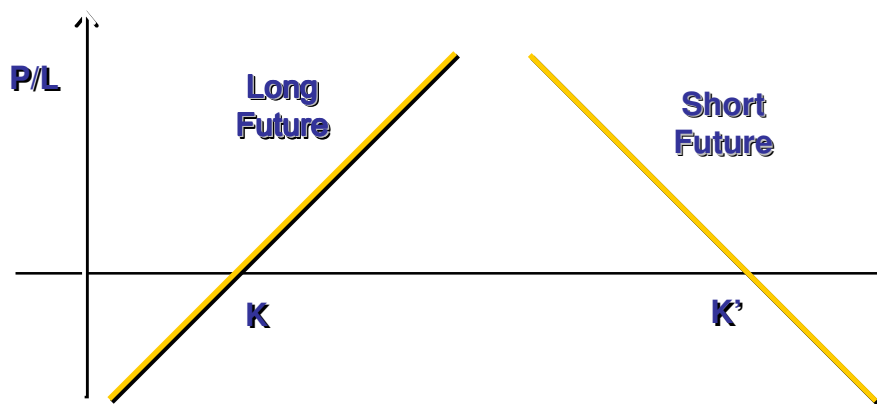
## Payoff profiles

- A payoff profile shows the payoff that would be received if the underlying is at its current level when the derivative expires
- It highlights the risks associated with the strategy in a **simple diagram**: a future has unlimited profit potential, but such a diagram also shows the potential losses
- It is easy to work with payoff profiles - they are **additive** meaning that we can add or subtract them from one another ---
- **useful in constructing more complex financial instruments or strategies**

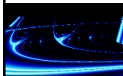


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## Derivatives as simple diagrams



**a future has unlimited profit potential, but such a diagram also shows the potential losses**

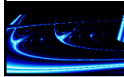


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## Gearing

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- Buy 1 New Gold (GLD) share @ R47 – market rallies to R50 – R3 profit (not a lot!); 6.3% return
- To buy 1000 shares will cost R47,000
- To get the same exposure as 1000 shares, buy 10 GLD futures contracts – initial margin: R4,000
- If you sell at R50, earn R3,000 profit AND get margin back (with interest) – return??



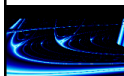
## What is an option?

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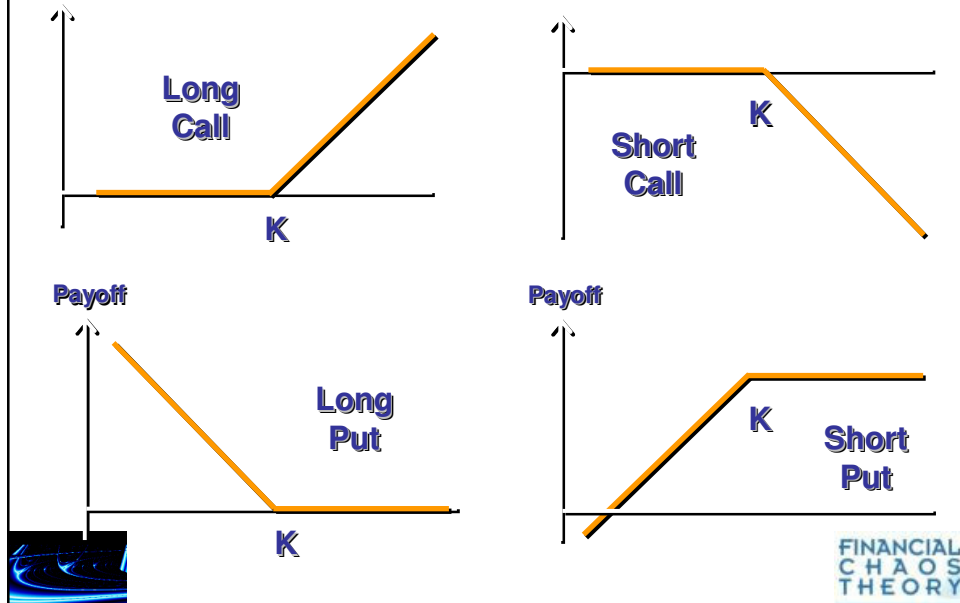
- Call option: gives the holder the right, BUT NOT the obligation to buy the underlying asset on a future date at a pre-determined price
- Put option: gives the holder the right, BUT NOT the obligation to sell the underlying asset on a future date at a pre-determined price

Payoff

$$V(T) = \phi \max[0, \phi (S - K)]$$



## Payoff profiles: non-linear derivatives - options



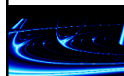
## The Black-Scholes formula

If you buy an option, you buy a RIGHT without any OBLIGATION – when the option expires, you can decide to exercise or not. This costs money – the premium of the option

$$V(S, t) = Se^{-d\tau}N(\phi x) - Ke^{-r\tau}N(\phi y)$$

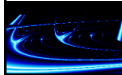
$$x = \left[ \ln \frac{S}{K} + \left( r - d + \frac{1}{2}\sigma^2 \right) \tau \right] \frac{1}{\sigma\sqrt{\tau}}$$

$$y = x - \sigma\sqrt{\tau}.$$



## Benefits of having a model

- the concepts behind the formula provided the framework for thinking about option valuation and dynamics;
- Due to research within the Black-Scholes framework many new insights into the market dynamics have come to light
- such research led to an expanded universe of financial instruments encompassing more complex option structures;
- quantitative risk management, stress testing and scenario analysis became possible;
- hedging of portfolios were easier;
- The market has progressed and expanded.

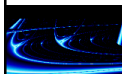
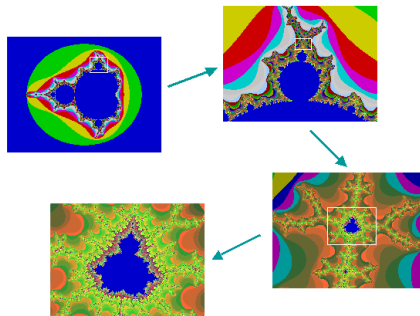


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## Types of options

- European – can only exercise on expiry date;
- American – can exercise any time on or before expiry
- Exotics;
  - Barriers, Asians, Cliquets, Ladders....

**New types of options are created nearly every day**

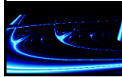


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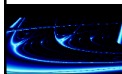
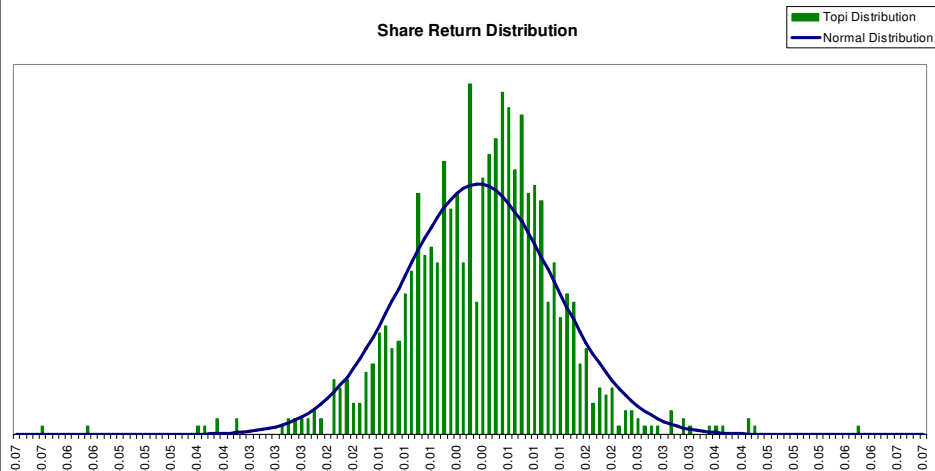
## Volatility: defined?

- **Volatility is defined as the variation of an asset's returns.**
- **Uncertainty. A measure of the stability or instability in the price of a stock.**
- **Volatility indicates the range of a return's movement. Large values of Volatility mean that returns fluctuate in a wide range.**
- **Fundamental assumptions used in assets models are that returns follow a normal distribution with a zero mean and that underlying prices are lognormally distributed. Thus, in a return's distribution, Volatility is the deviation of returns from their mean.**
- **If we assume the mean of returns is zero, then 10% Volatility represents, that in one year, returns will be within  $[-0.1; +0.1]$  with 68.3% probability; within  $[-0.2; +0.2]$ , with 95.4% probability, and within  $[-0.3; +0.3]$ , with 99.7% probability (according to a normal distribution).**



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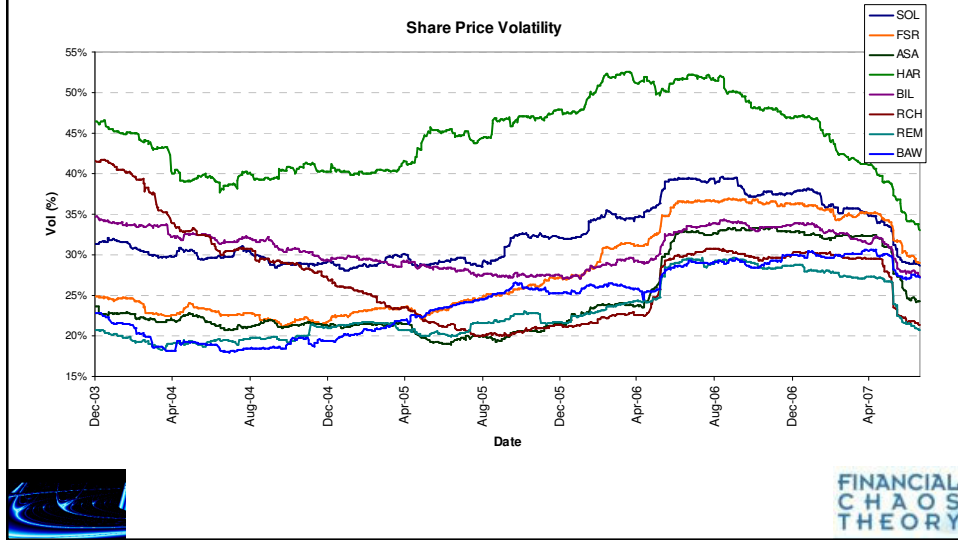
## Volatility: return distribution



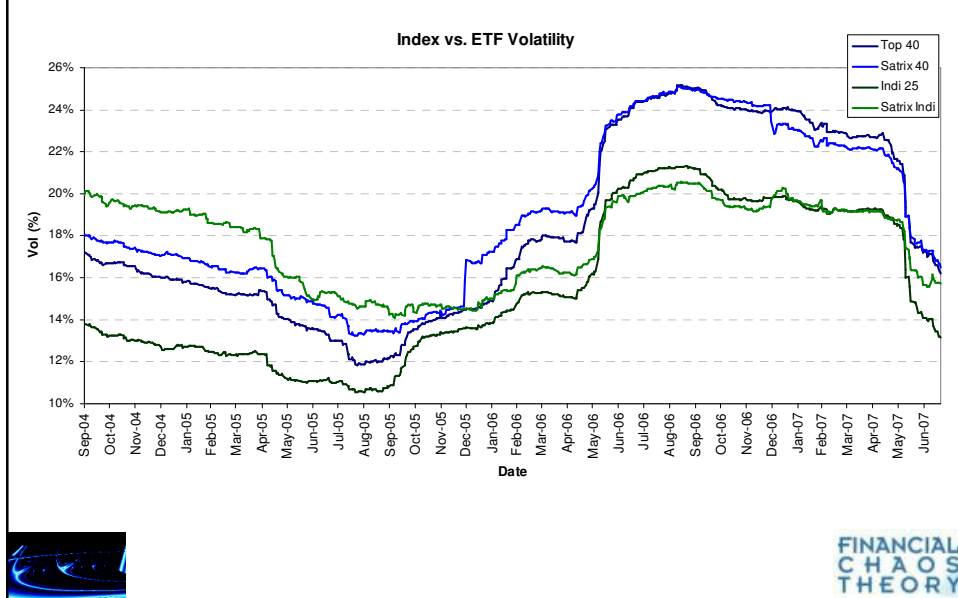
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## Volatility: shares

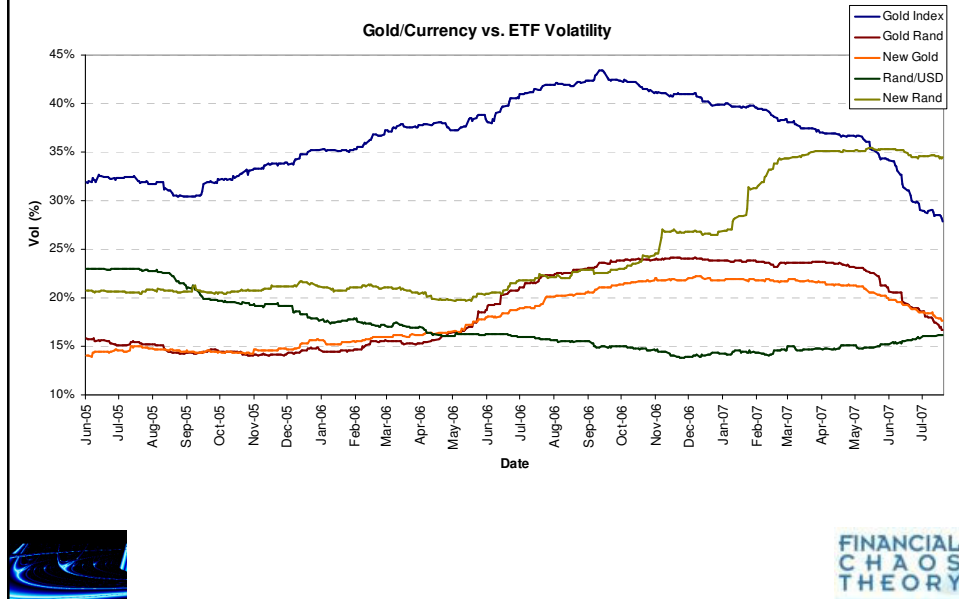
- Volatility of individual shares high



## Volatility: Index ETFs



## Volatility: Currency ETFs

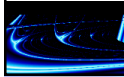


## Retail Investors: Hedging

- Wholesale investors (asset managers) are used to hedging portfolios with options on the Alsi; size counts
- 1 Alsi future gives exposure to  $\pm R265,000$  share portfolio
- Retail: use ETF instead

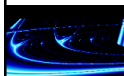
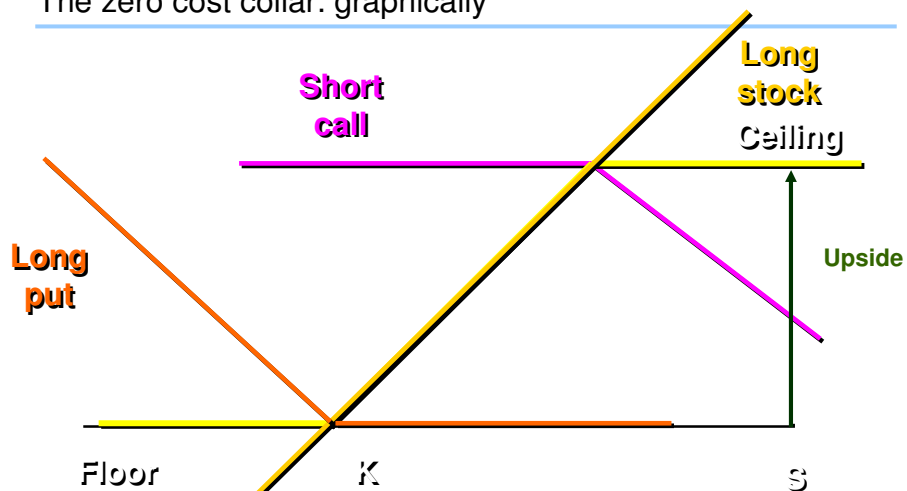
## Structured Notes: the zero-cost strategy

- Investor has a portfolio of shares he/she needs to hedge
- Investor buys an ATM put from risk taker – this costs money
- Risk taker buys an OTM call from the investor
- Strike of OTM call is determined by ensuring that the call premium is equal to the premium of the ATM put – total premium = 0



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## The zero cost collar: graphically



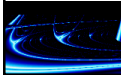
High volatility: lower upside

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## Advantages

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- **Hedge down side market moves with zero upfront premium**
- **Participates in upward moves**
- **Tailor-made in terms of strike and expiry**
- **Mostly done on the Alsi Top 40 index – asset managers**
- **Also suited to single stocks, especially ETFs with lower volatility – better deal for retail investors**



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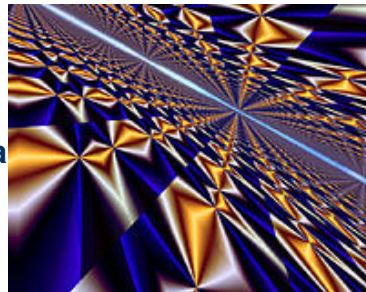
## Contact

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