



UNIVERSITEIT•STELLENBOSCH•UNIVERSITY
jou kennisvenoot • your knowledge partner

Financial Economics

Session 7: Derivative Assets

Postgraduate Class
Economics Department Stellenbosch

Lecturer : Nico Katzke
Nicokatzke@sun.ac.za



Department of Economics

DEPARTMENT OF
ECONOMICS



UNIVERSITEIT•STELLENBOSCH•UNIVERSITY
jou kennisvenoot • your knowledge partner

Derivative investments



Department of Economics

DEPARTMENT OF
ECONOMICS



Today



- Today we are going to look at another, perhaps fringe-type, **asset class** that investors can use as conduits for spreading their wealth over different time-periods.
- Up to now, we discussed several ways of intertemporal resource transferral, including purely keeping it in **cash** / a bank account (which would typically lead to inflation-erosion of wealth), buying **shares** in businesses (which provide an implicit hedge against inflation through increased business profits following rising prices... with ST volatility expected), or buying **debt** instruments (that have a fixed repayment structure and can provide efficient hedge against inflation, but not much more).



Today...



- The instrument type discussed today are **Derivatives**
- This asset class has been labelled by some (notably Warren Buffet) as *dangerous instruments with both the ability to greatly magnify either gains or losses*, although this is too broad a generalization to be fair.
- Not technically an asset-class in itself, a derivative instrument is an asset with a value that is **derived** from another asset, known as the ***underlying***.
 - It can also be in a contingency form – think e.g. of **home insurance**. The value of holding it cannot be measured on a day-to-day basis (in fact, this constitutes holding an asset with a ***negative expected value!***). Its value is derived from what it pays out if the house burns down – thus its value = **contingency security**.



Derivatives



- As the value of derivatives are derived from its underlying assets, it does not have an intrinsic value, but rather a **derived** value.
 - It merely represents a **claim** on either physical assets (maize, livestock, gold price, etc) and/or financial assets (stocks, bonds, property & outstanding debts), or contingencies at predetermined: t's & c's, negotiated prices and maturities.
- They are used as a means of effectively hedging and diversifying risk, securing sales and contracts as well as (more notoriously) to **speculate** on the movement of underlying asset prices...
 - **In fact, the JSE defines four types of buyers of derivative products:**
 - **Hedgers** (seeking to protect themselves from risk – **Insurance**)
 - **Arbitrageurs** (Profit off price discrepancies)
 - **Speculators** (opposite to hedgers in their drive *towards* profiting from risk - **betting**)
 - **Investors** (Scale the ups, hedge against the downs)



Derivatives: the idea.



- Derivatives can differ quite substantially & are typically **classified according to** the following criteria:
 - The **relationship** between the derivative and the underlying asset it is derived from (options, forwards, swaps, futures)
 - The underlying's **type** from which it is derived (**equity-**, **exchange rate-**, **interest rate-**, **commodity-**, **credit** derivatives, ...)
 - The market they are traded in (OTC or exchange traded derivatives)
 - Their maturities and pricing profiles
- Despite its notoriety following several crises linked to its **abuse**, derivative instruments provide investors with an efficient means of better managing the risk of their portfolios.



Where did derivatives originate



- The concept of derivatives is by no means new or novel.
- In fact, farmers in ancient Greece used derivatives to protect their future sale of olives using an **option-type contract**. Historical writings also suggest that the Japanese used it to secure their rice trading, and the Dutch are credited for having had a highly efficient and well-functioning derivatives market in the 1600s already.
- Since the 1980s, however, global financial markets have seen a dramatic expansion in the size and scope of global derivative markets, with its expansion only limited by the imagination of the quants who conjure them up.



Investor positions



- Before we delve deeper into the types of derivatives and look at its dynamics, let's consider first the type of positions investors can take when buying assets.
- When we think of an investor buying an asset – we think of it in the **natural** sense. **You buy the asset and hold it**, hoping it will increase in value (to compensate for the rate of time preference).
- Thus the expectation from the buyer should then , *by definition*, be that the asset will **increase** in value.
 - Note that the converse need not necessarily apply to the seller – who may sell for liquidity or other reasons too.
- But we know that investors can profit off **any** knowledge they have which the market (or opposite transactor – seller in this case) do not have.
- **HENCE: can an investor profit off the knowledge that an asset's value will decrease?!**



Investor positions



- Investors can hold one of two positions:
- **Long position** (or going long / having a long position on an asset): is a buy-and-hold strategy where the investor believes the value of the asset will increase, and hopes to profit off it.
- **Short position** (or shorting an asset): is the borrowing and then selling of an asset, with the intention of buying it from the market and delivering it back to the owner at a later stage – **in the hope of profiting from a price decrease** in the time when the asset was loaned by the initial owner (i.e. paying the original owner less than what it sold for when you borrowed the asset).
 - This is done as a means of profiting off the decrease in an asset's value



Short-selling



If you intend to sell an asset short – this is more or less how the process will work:

- Suppose you think that Alibaba shares will ↓ in value.
- You then borrow 100 shares at a price of R6.50 from a broker having these shares. The borrowing rate is say 2% (thus: 2% of R650 = R13).
 - The borrowing rate depends on demand and supply of loanable shares, as well as homogeneity of beliefs surrounding asset price movements (if everyone believes resource shares are set to fall, e.g., borrowing costs will be very high).
- You then sell the shares at just below the market price, say at R6.40 off to someone else, even *though you don't own it*, giving you R640 in the bank.
- In time, of course, you will have to “**close**” the short position – i.e. buy the shares from the market and return it to the original owner from which you borrowed it.
- If, say in a month's time, the market price has dropped to R6.10, you would buy it (R610) and return the 100 Alibaba stocks to the lender.
- The profit made = $R640 - R13 - R610 = R17$ **Owner still receives dividends while loaned**



Problems with too much short selling?



- Short selling can reinforce **downward** market momentum of asset values → as it makes downturns profitable to short-sellers, which increases eagerness to sell in the market.
- Short selling could also lead to costly **short squeezes** making the market more volatile.

A short squeeze is caused by an unexpected **upswing** with regard to a shorted asset, causing short seller losses to rise – as a rise in prices of a widely shorted asset forces the short sellers to frantically buy the stock in an effort to cover further losses (funds have to mark -to-market) – leading to the amplification of the share’s upward price movements... Thus short selling can actually increase market momentum in both directions – and thus leads to increased market volatility.



Short selling



- Short selling can also lead to serious **distortions** in asymmetric **market information**. Short sellers have at times been blamed for spreading negative rumours and instigating bad news on companies in order to scare investors and depress the market value of a company's share.
- This follows as it has been shown extensively in research that negative news has a larger price impact than positive news on asset prices (Leverage effect).
- *There are some notable examples of how short-selling has been used in response to information*



A few notorious Short Sellers



- Infamous investor, **Jess Livermore**, was widely blamed for being a main driver of the stock market collapse and subsequent 1930s Great Depression in the US when short selling in the market and collecting roughly \$100 million for his efforts. Public outrage caused a temporary ban on short selling...
- **Isaac Le Maire** was blamed for misusing his influence as a prominent shareholder in the Dutch VOC to drive down share prices by selling large quantities, and profiting from short sales in the process. The Dutch temporarily banned short selling as a result in the 1600s.
- In contrast, the “nosey” investor, **James Chanos**, believed Enron shares were overvalued and in his effort to profit from this, uncovered various discrepancies in their accounting practices. Much of the information he recovered (in an effort to profit from it) were used in the final conviction of the fraudulent behaviour of Enron’s executives... saving other investors from further losses in the process.



A few notorious Short Sellers



- George Soros pulled off one of the greatest trades of all time— using a leveraged short position on the British Pound on September 16 1992.
- At the time, England was part of the EU ERM – which was a quasi-fixed exchange rate system (effectively pegged to the Deutsche Mark) – and the British had substantial pressure from other EU countries to devalue the Pound, which it stubbornly refused to do...
 - It set out to keep the value pegged at 2,7 DEM to the GBP
 - But with inflation much higher in Britain, and interest rates low – this became untenable, and was clear for speculators to see that keeping this peg was infeasible.
 - Britain hiked its rates in an effort to strengthen its currency, but to no avail.
 - Government orders were that the fiscal authorities must buy pounds if it is in large amount on the open market to control the value of the pound.
 - That is until Soros (and a few others in the market) flooded the market with pounds to the degree that the British were forced to exit the ERM and float their currency (i.e. they could no longer afford to quasi fix the pound).
 - **Soros, as a result of his leveraged short position, made \$1bn for his fund in one day.**



Banning short sales feasible?



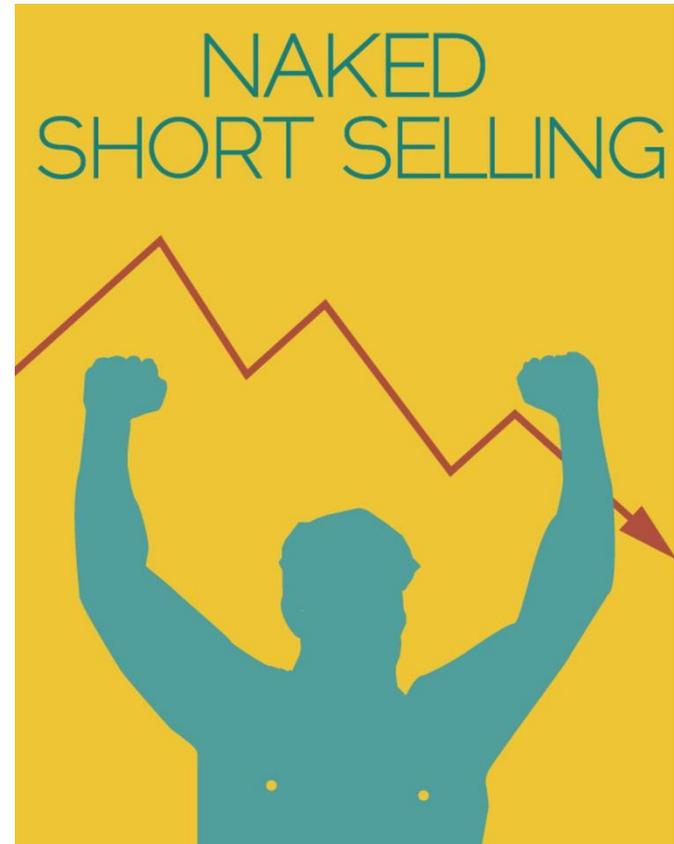
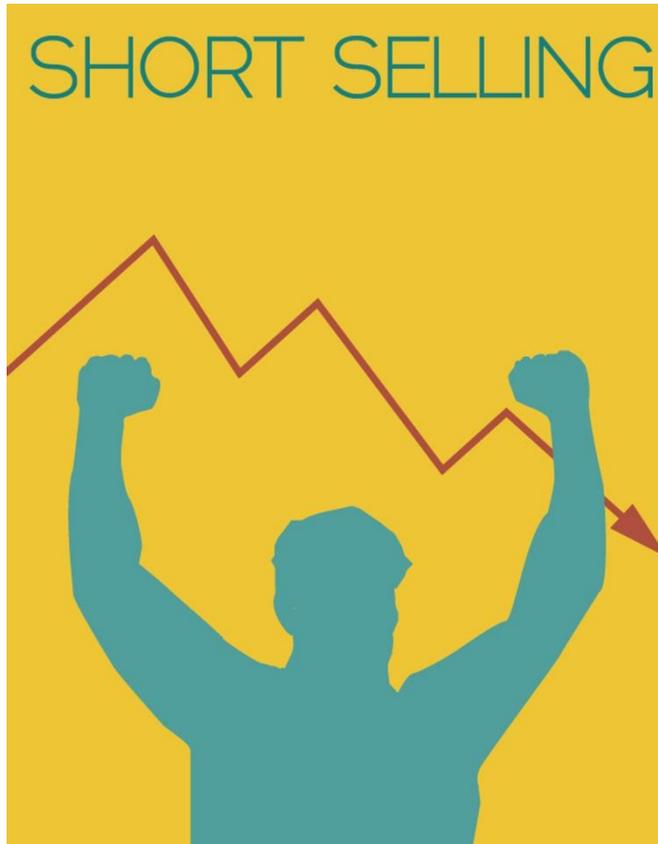
- Throughout financial history it has not been too uncommon for regulatory authorities to curb or even attempt to prohibit short-sales for a time.
- Recent examples following the subprime mortgage crisis include short-sale limits in the US (following Lehman's collapse), France, Belgium, Spain and Italy imposed restrictions on short selling for a 15-day period in mid 2011, and more recently Spain and Italy banning short-sales in their respective equity markets in 2012.
 - Spain banned short-sale strategies on equities through share-, derivative- and OTC- trading for 3 months, while Italy banned it for a week in June 2012.
- Such bans were done in an attempt to prevent bearish speculators from gaining control over the market and to halt the strong ↓ momentum in mkts.



Banning short sales feasible?



- But are such bans feasible? Should / Could it be banned indefinitely?!
- The simple answer is NO, as short selling is a **natural phenomenon** in financial markets. Banning it from exchanges will merely force investors to conduct short-selling through unregulated OTC transactions – making it less transparent and potentially even more destabilizing.
- Battalio, et al (2011) also find that banning short-sales do little to limit share price losses, yet add cost to investors in terms of liquidity constraints.
- Short-selling also adds to market **liquidity** and provides **valuable information** on market expectations. In addition, it provides an **incentive** for investors to find and **expose overvalued stocks** – leading (at least in theory) to a more fundamental market price for stocks.



Courtesy of Robert Smith and Lam Thuy Vo / NPR



Example of Naked Shorting Scam



- In 2014, two prominent US professors managed to set up a naked shorting scam and earn loads of money illegally.
- See this article for how they did it:
- <http://www.bloombergtview.com/articles/2014-02-03/florida-professors-experimented-with-a-little-naked-short-selling>
- (read this **only** for interest sake – if it interests you of course...)



Summary of the professors' Naked shorting scheme



- They traded with each other, and split their earnings – trading in hard-to-borrow stocks.
- Typically when short, you have to borrow the stock that you are shorting (cost to doing so).

Suppose:

- A hard-to-borrow stock can be loaned out to short sellers for, e.g., 3% per year.
- If you owned the stock you make 3% a year just lending it out (but, remember, you still have price risk).
- If you're short the stock you have to pay 3% a year to borrow it (and you have price risk).
- **Scenario 1:** You work alone and legitimately, then you're long the hard-to-borrow stock in one account and short the hard-to-borrow stock in another, then you have no price risk, can get paid 3% percent for lending from the long position, and pay 3% to borrow to fund the short, leaving you with a nothing (pointless exercise).
- **Scenario 2:** But if you're in a team and are naked short, you can be long the hard-to-borrow stock in one account, while simultaneously being naked short the hard-to-borrow stock in another: leaving you with no price risk, getting paid 3% for lending, pay nothing to borrow (because you're not actually borrowing), ultimately leaving you with nothing but a free 3% percent return.



Back to derivatives...



- Although short sales are different from the traditional sense in that it provides investors with the opportunity to profit off losses - it is not regarded as a derivative instrument / technique in itself, but nonetheless important to consider before discussing derivatives further.
- Knowing now that **investors can profit off any news / information in the market**, the need naturally arose for the creation of derived assets that could either resemble factors that do not exist in itself (and can thus only track other factors), or allow investors to bet (hopefully profit) / **hedge** (protect from unknown) on the possible occurrence of future events (known as contingencies).



How are derivatives traded?



- Derivatives can be traded in two main ways:
- **OTC** derivatives are traded directly between counterparties, normally with accompanying legal documentation and often with an underwriter / third party.
- **Exchange traded derivatives** can be traded by placing an order at a stock-broker (much the same way you'd go about buying any other financial asset), with the broker then tasked to find a counterparty to your enquiry. These are typically standardized traded products



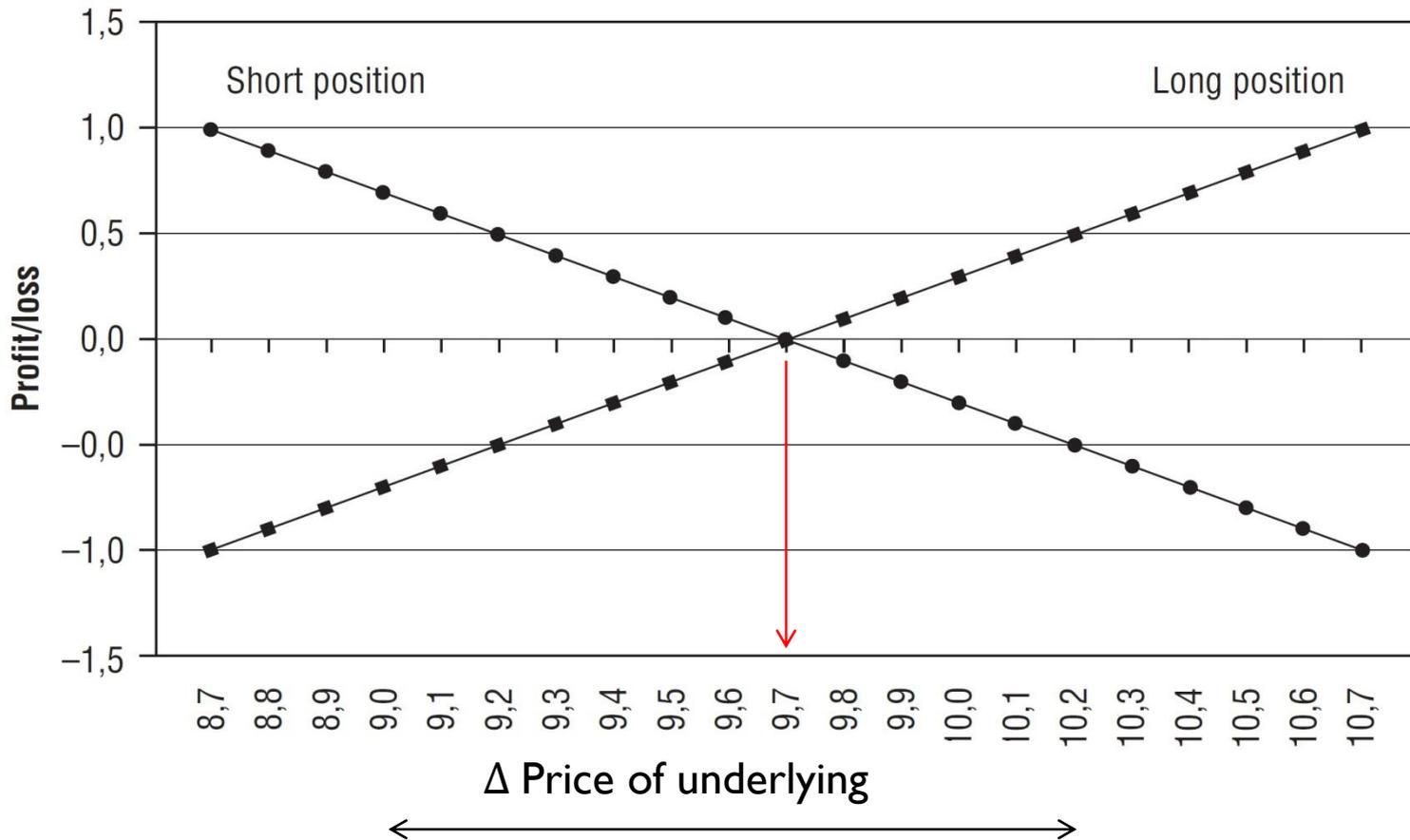
Four main types of Derivatives



- **Forwards**: a contract where two parties agree to trade an asset (financial, physical, etc) on a future date at a fixed price. This is a non-negotiable agreement between two parties (OTC type), and as such are customized to tailor their specific needs.
- **Futures**: This is merely a formalized / standardized Forward contract, and is sold on an exchange and not negotiated by two parties. As such, the seller is protected against default of terms.



Graphical example of a **Forward** transaction



If the **price expiration** is \$9,40 the seller will make 30c profit and the buyer of the forward a 30c loss.



Four main types of Derivatives



- **Options:** Options provide the investor with the **option (not the obligation)** to buy / sell the underlying asset...
- **Two types of Options exist:**
 - **Call Option** – provides the purchaser of the Option **the right** (but not obligation) **to BUY** (or “**call** hither”) the underlying asset at a predetermined price on a predetermined future date (Note: This can be as a **short** or **long** Call Option)
 - **Put Option** – provides the purchaser of the Option **the right** (but not obligation) **to SELL** (**put** down) the underlying asset at a predetermined price on a predetermined future date (Note: this can be as a short or long Put Option)



Four main types of Derivatives



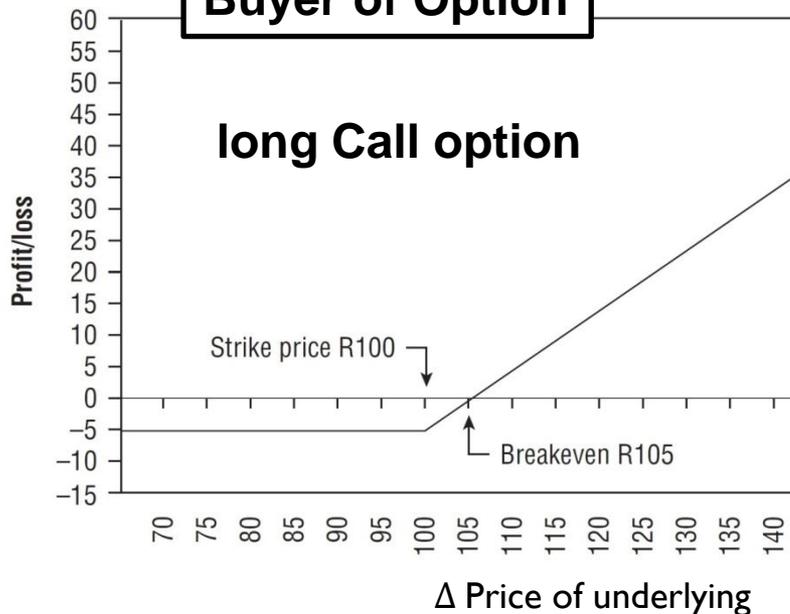
- Notice that for an Options contract, the obligation is **lopsided** – i.e. the **buyer's** downside is **limited to the premium** paid for having an option (because he has the option of not exercising right, losing only the premium), while the seller of the option is **not covered** and has unlimited potential losses (his part of the contract is binding).
- The **Option** is defined by the agreed upon:
 - **Underlying security & Expiry date** (date on which option expires – can normally exercise option before this date)
 - Exercise (**strike**) price – the **price** agreed upon **up-front for which the asset will be bought / sold** at in the future
 - **Premium** – The price the purchaser has to pay for the right to exercise the put / call option on the maturity date.
 - **Initial margin** – is a deposit that is required by the **clearing house** to cover potential daily losses on the derivative (this is like a deposit on a house, as it will be returned, with interest, on expiry – but protects the seller from the buyer's potential bankruptcy or inability to make good on losses)



Call Options: Long / Short!



Buyer of Option

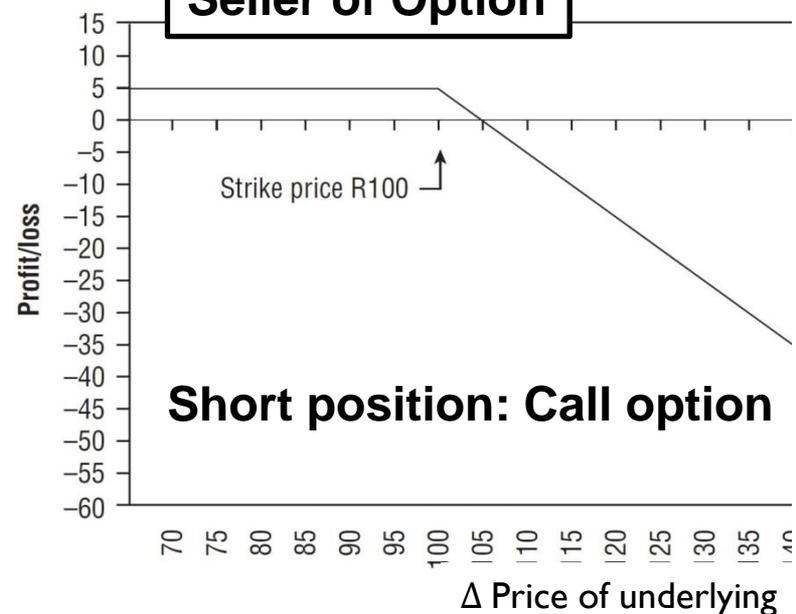


Suppose the **strike price** of the option is **R100** and the option price or **premium** is **R5**.

The Long Call position is **profitable** if the market price of the share exceeds the strike price of R100 by more than R5

(i.e. if Spot at maturity > R105 you are **in-the-money!**)

Seller of Option



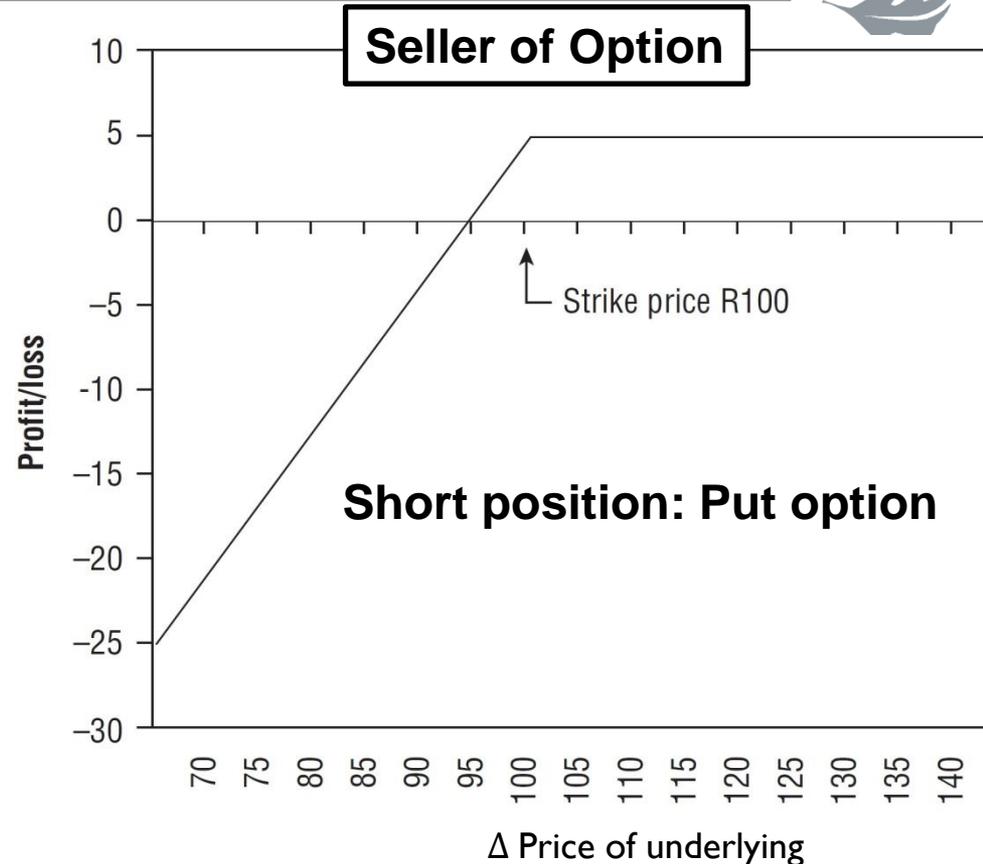
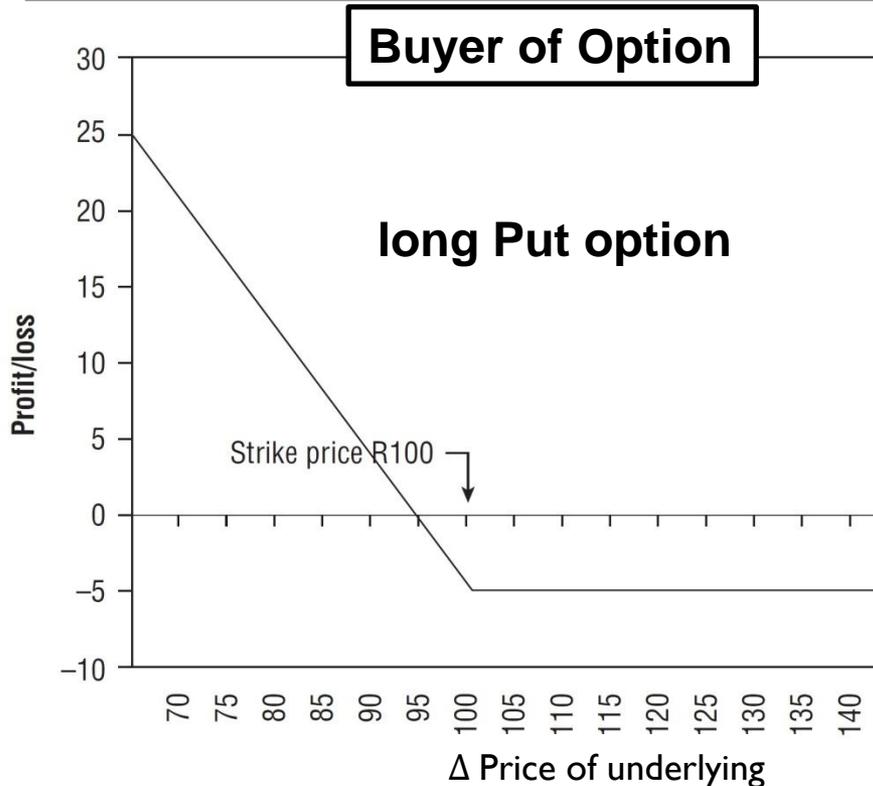
The seller of the Call Option (holding the short position)– believes the price will be lower than R105 in the future.

Notice that the seller (as seen above) has a maximum profit of R5... But an infinite potential loss!

This implies a **lop-sided** agreement...



Put Options: Long / Short



Similar as before, just mirrored, the long Put Option position is profitable if the market price of the share **falls** below the strike price of R100 by more than the option price of R5 ($P < R95$)

Only then will the buyer of the Option opt to **buy (call)** the share

Again, the seller of the short position for the Put (or seller of the option), has limited profit.

Sellers normally hedge their downside (seen later).



Four main types of Derivatives



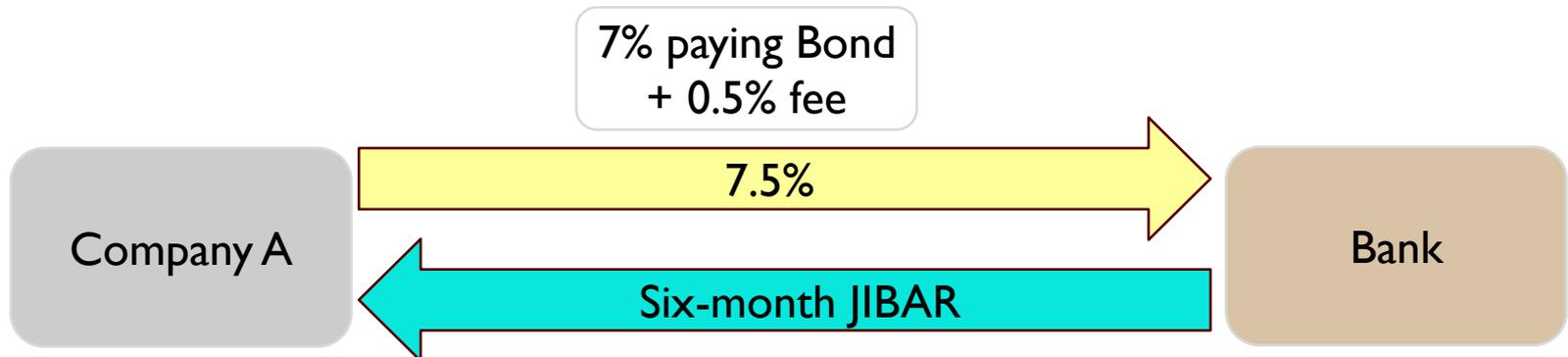
- **Swap:** Swaps are contractual agreements whereby two parties (counterparties) agree to **swap a series of cash-flows** (e.g. Coupons, dividend and capital gains, forex payments, etc) at specific intervals for a specified time-period.
- Swaps can be in the form of FI instruments (e.g. Coupons), currencies (foreign investments/payments), equities (pegged to something like an index) and commodities as its underlying
- It can also be in the form of an Option agreement, called **Swaptions** (giving the buyer the option to swap in the future)



Swaps: Interest Rate



- Suppose that Company A holds a **fixed-rate bond** that pays **7%** p/a bi-annual coupons
- Suppose too that their in-house economist predicts **interest rates in the market to rise substantially in the following year.**
- They can then enter a Swap agreement with a bank / investor, in which they pay 7.5% in exchange for a 6-month variable rate pegged to e.g. the JIBAR (minus the bank's credit spread to cover its risk).

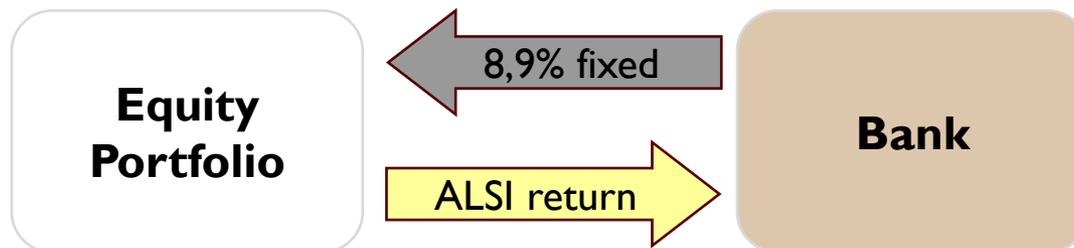




Swaps: Equity



- Equity swaps can be used to convert **volatile equity returns** into **stable fixed-income** returns for a period
- For example, assume a unit trust holds a diversified equity portfolio highly correlated with the return on the ALSI (Remember this implies a high β portfolio!)
- It wishes to pay the ALSI return to a bank (seller of the Swap) and to receive a fixed-rate in return, thereby hedging the pre-existing equity position (Suppose the bank prices the swap at 8,9% p.a.):





How derivatives work and are priced



- **Futures and Forwards** are relatively easy to understand i.t.o. pricing:
- It is important to first consider whether the asset has **financing costs (fc)** (cost of storing underlying asset to the expiry date) and / or **cash-flows (cf)** (accrued in the time of holding it, e.g. a bond's coupon payments).
 - The net carry-cost (cc) = (fc – cf).
- Thus, if the current market price is known as the **Spot price (S)** and the **Future price (F)** is what is the price agreed on to settle in the future, a fair (expected) futures price should be:
$$F = S \cdot (1 + cc) = S \cdot (1 + (i - d) \cdot n) \quad \rightarrow \begin{array}{l} i = \text{cost of financing} \\ d = \text{income earned} \\ n = \text{periods} \end{array}$$
- Of course, this is **not an identity** and normally include risk premiums. The **Basis** is $(F - S)$, and will of course be **zero** at expiry, and **vary** before it



How derivatives work and are priced



- Options pricing can be more tricky, as it has many components and considerations **due to its lop-sided nature**.
 - American options can be exercised any time up until maturity (more expensive typically as it has more uncertainty), while European Options only **on** maturity.
- The **intrinsic value** of an Option (call):
$$\text{Intrinsic} = \text{market P} - \text{Maturity P} = \text{Spot} - \text{Strike}$$
- If **Spot** > **Strike**, the **Call Option** has **positive** intrinsic value and thus the Option is known as **in-the-money**
- The **opposite** of the above applies for a **Put Option** (here **in-the-money** would imply **Spot** < **Strike**).
- An option can also be **at-the-money** (intrinsic = 0) or **out-of-the-money** (intrinsic < 0)



How derivatives work and are priced



- The intrinsic value of an Option, however, does not provide information as to the volatility of the underlying asset (risk to the seller). The **complexity** in the pricing of an Option (premium) comes in when we consider that the **premium** should reflect:
 - The **Time to maturity** of the option (longer time = more uncertainty)
 - **Expected future volatility** of the underlying asset (i.e. ability to deviate from expected outcome).
- Calculating **intrinsic value** for forwards and futures are thus relatively **simple** compared to calculating time value for options.
 - The European Option pricing model were first developed by **Black, Scholes** and **Merton** in the 1970s.
 - The volatility input of the underlying is based on both historical and future assessments



Various types of underlying assets



- Within each of these categories, derivatives can be based on almost any form of asset / variable as an underlying.
- Examples include:
 - Currency options – where investors can bet / hedge against predetermined bilateral or multilateral exchange rate movements.
 - Agricultural futures contracts – securing future sales of agricultural produces / providing investors with an opportunity to profit off future price movements.
 - Interest rate swap agreements – here the payments of variable rate coupons can, e.g., be traded for the payment of fixed coupon rates for a pre-specified period of time. This allows investors to profit / hedge on information regarding future interest rate movements.
 - And the list goes on and on...



Exchanges, Counters and Clearing houses



- Derivatives can either be traded over-the-counter (OTC) or on an exchange.
- OTC derivatives make up the most of the transfers, as it can be tailored specifically to the speculative / hedging needs of the investor.
- Exchange trades offer the investor **less flexibility**, but by definition **more protection**, in terms of counter-party risks and liquidity.
 - The JSE has four derivatives markets traded on **Safex**, which include:
 - **Equity-** , **currency-**, **interest rate-**, and the **commodity** derivatives markets.
- Exchange traded instruments also have a clearing-house that facilitates investments and ensures high liquidity. The JSE has its own clearing house: **Safcom**.
- The clearing house plays an important role in providing counterparty protection, facilitation of transfers of funds and settling of contracts.



Exchanges, Counters and Clearing houses



- The **clearing house** acts as counterparty to all transactions entered into on the exchange, and assumes the contractual relationship between the buyer and seller.
- The clearinghouse is responsible for determining the profit and loss on all open positions by revaluing them at the end of each business day at the closing contract prices traded on the exchange → marking-to-market.
- The clearing house then also allows the development of a secondary market, as investors need not hold contracts to maturity – as they can sell their position to some other investor in much the same way as you would any other asset. The clearing house merely nets-out the position.
- An example you should all be familiar with is that of commodity futures trading. On the news you will see daily prices given for, e.g., maize price futures. Does this mean you can physically buy a ton of maize?!
-



Commodity futures as example of clearing house role



- The Safex is a highly liquid platform for investors, buyers and producers to trade commodity futures contracts and options.
- Although physical delivery is an alternative (you could have the ton of wheat delivered to your silo...) most contracts are settled in cash through Safcom as facilitator.
- This implies you can buy / sell a contract for a ton of wheat, with the intention of closing the position at a later date (and definitely not consuming it), with the clearing house settling the difference.
- Producers (such as Simba) could have the wheat physically delivered.
- **Note:** *If an investor expects future price rise he should **buy** a futures option / contract and **sell** if he expects a decline.*



Could you forget to close your position?



- Not easily no.
- Brokerage firms watch their open accounts and know who has long or short positions in contracts nearing maturity.
- Prior to delivery day, they inform customers who have open long positions that they must either **close out the position** or prepare to take delivery and pay the full value of the underlying contract.
- By the same token traders with short positions are informed that they must close out their trades or prepare to deliver the underlying commodity.
 - Closing a position would then imply entering an opposite trade: Selling the positions you bought, e.g. and *vice versa*



Equity index futures on JSE



- The JSE's Safex also provides efficient equity derivatives in the form of standardized equity index futures.
 - There are currently 13 equity index futures in SA, from the Top 40 (Alsi)- to the financials-, gold mining- and listed property indexes.
 - Investors can also trade single-share options (max of 5 contracts).
 - This gives an investor an easy and efficient way of buying long / selling short a basket of shares at a pre-determined price on a future date. Unlike commodity futures, these contracts are **cash-settled**, with differences in the price settled on and the actual price in the future, being paid over by Safcom to either the buyer / seller – these are called CFDs (Contract For Difference)
- **1 Single Stock future** on the JSE = **100 Shares** of the underlying
- **1 Index Future** = **R10 per point movement.**



Leverage



- These futures therefore allow investors the ability to magnify profits on investments through **leverage** / gearing.
 - This follows as such contracts expose the holder to more underlying shares than the initial margin put up by buyer. **1 Future = 100 shares.**
- These instruments can also be used in short sales.
- How does this work?
 - The investor pays an **initial margin**, typically around 10%, - 20%
 - **Zero-sum game** – someone wins & someone loses: profits and losses are calculated on a daily basis, and the **exchange just ensures that the margin value is kept.**
 - Margin is returned to investor (if not used) with interest and is merely kept safe
 - Such contracts are auctioned and / or expire on the 3rd Thursday of every March, June, September and December at 12:00 noon.

Example:

An investor believes that the MTN share price, that is currently trading at R150, will increase over the next month...

The investor then chooses to buy a **single stock futures** contract on MTN shares - with an **initial margin** (deposit) of 10% → thereby giving him exposure to **100 MTN shares** (single stock futures are often quoted in 100s)

- The initial margin put up for the futures contract is 10% of 100 shares – thus :
 $10\% \text{ of } R15\,000 = R1500.$
- Thus the investor is **exposed to R15000** worth of MTN shares, **paying only R1500**.
Thus he has **leveraged / geared** his investment **10:1**.
- Three months later the shares are trading at **R185**. The investor closes out the position.
- He receives his margin back, plus interest, plus the difference in price on the shares, thus realising a profit of:

$$\textit{Profit} = (18\,500 - 15\,000) = R3500 \text{ (on a } R1500 \text{ investment!!!!)}$$

- Thus he has greatly magnified his returns (if invested directly, he would have earned only):

$$R1850 - R1500 = R350.$$



Leverage



- Although the example illustrates the power of leveraging in magnifying returns (note the investor, with a 10% exposure, earned more than 10 times what he would have had he not leveraged and merely bought long!) it also has the power to magnify losses.

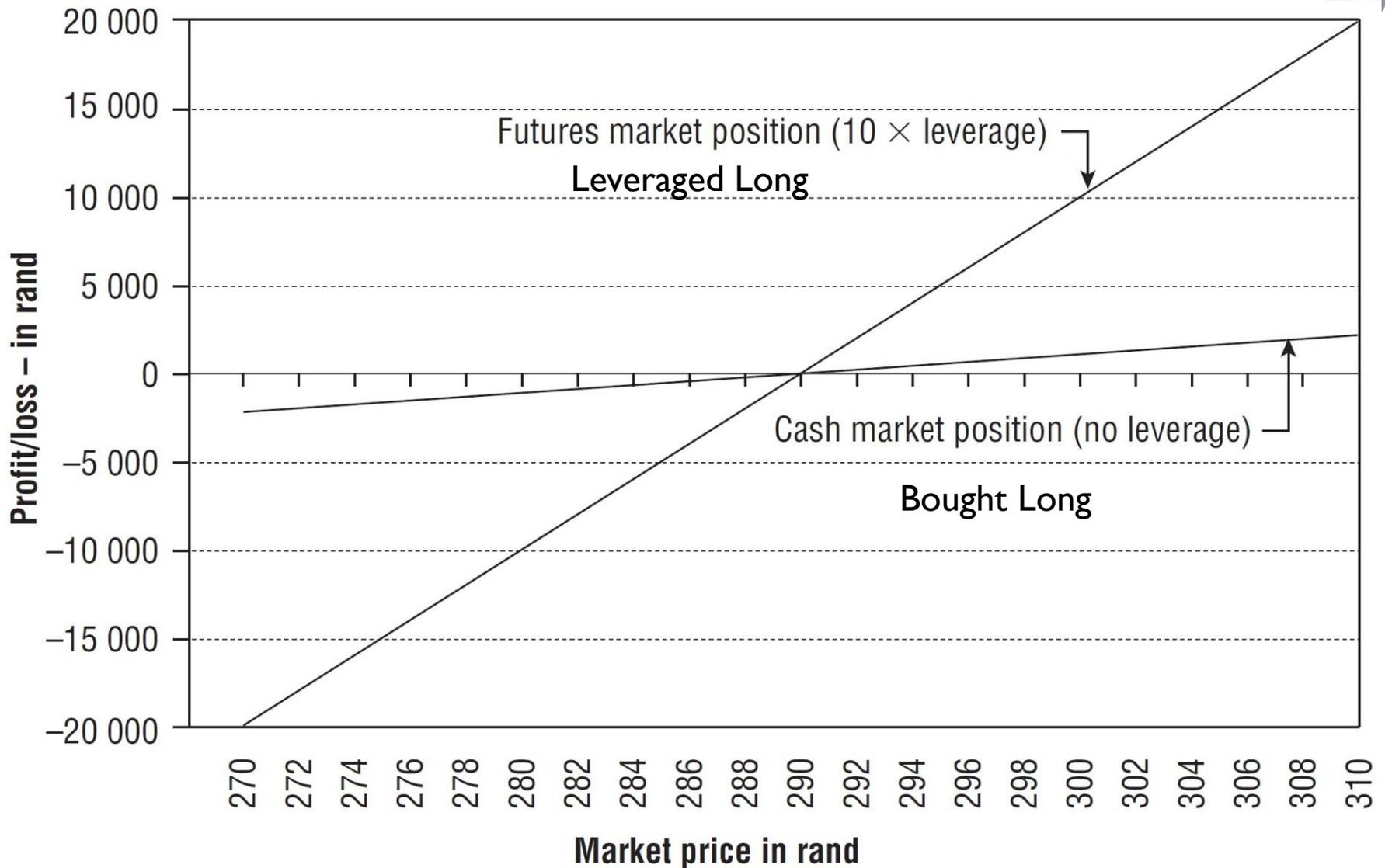
- Suppose MTN shares traded for R140 at expiry.
- That would imply the investor realizes a loss of:

$$R14000 - R15000 = R1000$$

- Thus he will only get R500 of his margin back (and would have had to pay in if it exceeded the margin).
- He has thus effectively lost R1000 from the derivative (and would have lost only R100 if he bought long instead...)



Difference leverage makes for profits & losses





Who wins and who loses with **derivatives**?



- It should have become clear by now that **someone necessarily wins, and someone loses** when a derivative contract is written → i.e. profits made are not free lunches!
- This is because two parties need to differ in their opinion of future outcomes in order to reach an agreement.
 - Does this then imply that all investors / companies going into derivative agreements are speculating?!
- Note that although it is a **zero-sum game**, it is **not a zero-utility game**.
 - This follows as a party may gain utility from being secured in one end of the market
 - **E.g. a company may happily pay to hedge against currency risks, even if a currency blow-out is highly unlikely and it being therefore technically a “bad” investment - as hedging it allows for long term planning as the hedge has removed currency uncertainty!**



Who wins who loses?



- Think of it this way : would you **Rationally** hold an asset with a **negative expected pay-out?**
- Of course you would! ... It is called **insurance!**
 - You would hope your bet on insurance is wrong and that your house will not burn down and you “earn” a negative return from holding the “asset” of insurance.
 - This is because you derive utility from holding insurance as there is a premium to “*peace-of-mindness*” (if that word existed).
 - Thus both parties benefit in a derivative transaction, despite one “losing” at the end.



Market Neutral Portfolios



- One could also follow a defined strategy of focussing on company idiosyncracies only.
- Such a strategy could imply going long / short stocks in a market, while always taking the opposite position on the market.
- This way, a fund's exposure to the market is zero, focussing solely on company / sector specific information – not affected by market gyrations.
 - This implies a portfolio with $\beta = 0$.
 - A benefit of such an approach is that fund managers could then focus more on company specifics as opposed to spending time studying broader factors which influence market returns.
 - Note such funds could perform well even in bear markets.



Long/Short (Spread) Portfolios



- Fund managers could also trade spreads, at a pre-defined margin.
- An example of how such a strategy might work is, e.g., if we find two firms in a similar sector and which are generally exposed to similar shocks – deviate in their returns from their longer term paths, we can go long the low stock and short the higher stock, thereby trading the spread.
- If the spread between the two companies then narrows, we earn positive profits.



Currency derivatives



- The JSE's **Yield-X** provides a platform to trade **standardized currency futures** and -options (minimum of 1000 forex units, e.g. \$1000)
- For currency futures or options, this can be a useful tool in protecting a portfolio from currency depreciations or speculating on ER movements
- As an example, investors can speculate / hedge on the following info:

<u>Expect rand Depreciation:</u>	<u>Expect rand Appreciation:</u>
Investors can buy (long) a Currency Future	Investors can sell (short) a Currency Future
Importers can buy a Call Option as protection	Exporters can buy a Put Option as protection



Interest rate derivatives



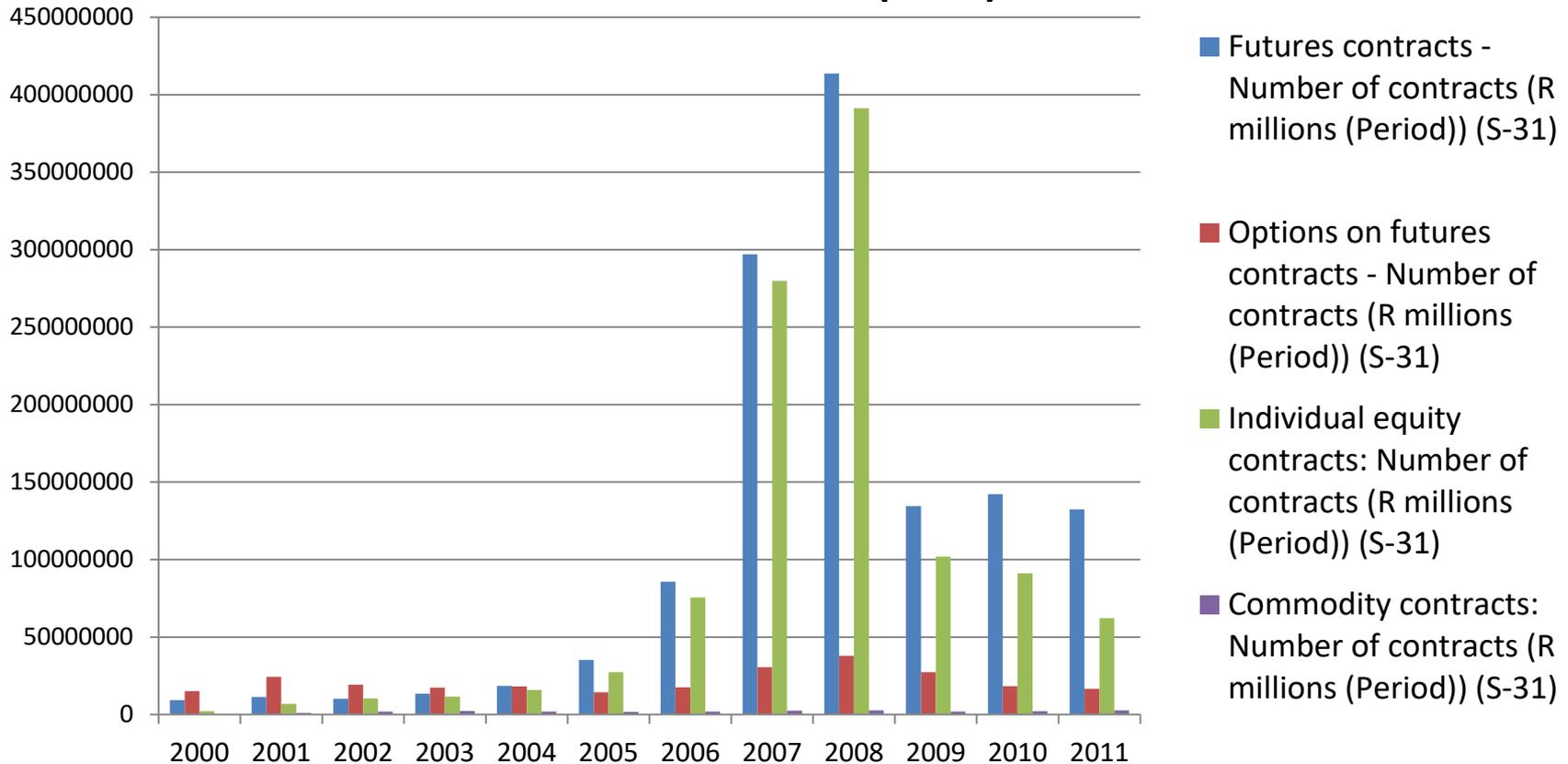
- **Yield-X** also provides a platform for trading standardized interest rate derivatives. These include:
 - Bond Futures and Options
 - Fixed-income index Futures and Options
 - Standardised Swaps, as well as Notes, FRA's, etc.
- This allows investors to hedge / speculate on the movement of interest rates in the future. E.g.: Expecting volatility in interest rate movement, an investor might enter a **Swap** agreement by swapping the variable rate payment of a FRN instrument for the fixed-rate coupons of another instrument for a pre-specified time period.
 - Interest-rate derivatives account for nearly 80% of global derivatives trading.



Derivatives in SA:



Growth in the Number of derivative contracts in SA before and after the GFC (Rmn)





Exotic derivatives (Just for interest)



- Exotic derivatives are non-standard derivatives and can range from a combination of two or more vanilla derivatives to complex financially engineered instruments.

Range forward contract	A forward foreign exchange contract that specifies a range of exchange rates within which currencies will be exchanged at maturity
Break forward contract	A traditional forward foreign exchange contract that allows banks' customers to break the contract at a specified exchange rate if the spot rate at maturity is more favourable than the forward rate specified in the contract
Average-rate option	Depends on the average price of the underlying asset over a specified period of time
Look-back options	Give the right to buy (call) at the lowest price or sell (put) at the highest price recorded over a specific period of time

<p>Barrier options</p>	<p>Have a mechanism to activate or de-activate the option as a function of the price of the underlying asset. Their payoff depends not only on the pre-agreed strike price but also on a second strike – the barrier or trigger</p>
<p>Rainbow options</p>	<p>Provide the highest performance of two or more chosen markets</p>
<p>As-you-like-it option</p>	<p>Allows the holder to choose after a specified period of time whether the option is a put or a call</p>
<p>Roller-coaster swaps</p>	<p>Provide for a period of accretion followed by a period of amortisation of the principal</p>
<p>Forward swaps</p>	<p>Swaps where the swap coupons are determined on transaction date but the swap does not commence until a later date, for example 30 days, 60 days, one year forward</p>



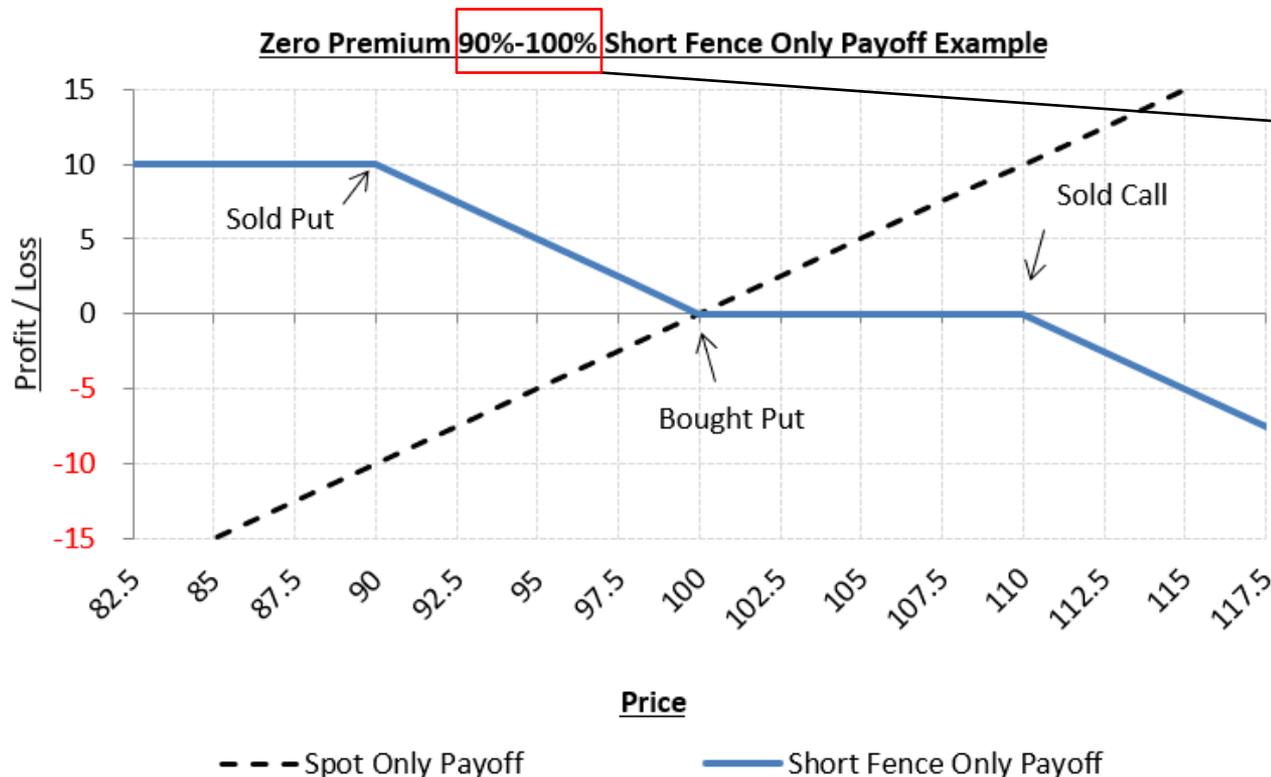
RISK MITIGATION STRATEGIES USING DERIVATIVES



Payoff profiles: Short Fence



- Fence options is a defensive strategy where an investor pays some potential upside to secure the downside of an investment.
 - A **short fence** is constructed by selling a put option with a strike **above** the current spot, buying a put with a strike at or just below the spot, and selling a call with a strike below the first put's strike (all of these at the same expiration)



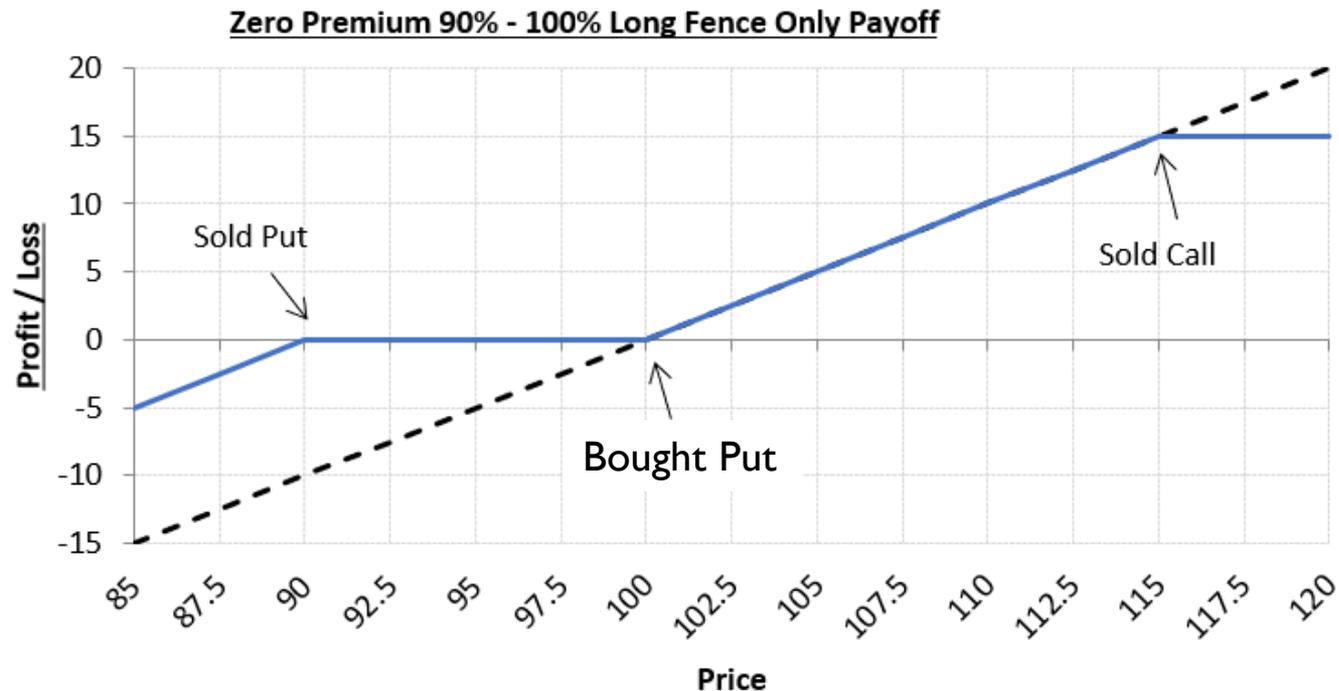
Percentages refer to “at-the-moneyness”
e.g. when buying a put:
100% is at the money, 90% is out-the-money, 110% is in-the-money: in relation to the strike price.



Payoff profiles: Long Fence



- Fence options is a defensive strategy where an investor pays some potential upside to secure the downside of an investment.
 - A **long fence** is constructed by selling a call option with a strike **above** the current spot, buying a put with a strike at or just below the spot, and selling a put with a strike below the first put's strike (all of these at the same expiration)





Payoff profiles: Short Fence



Zero Premium 90%-100% Short Fence + Spot Payoff Example

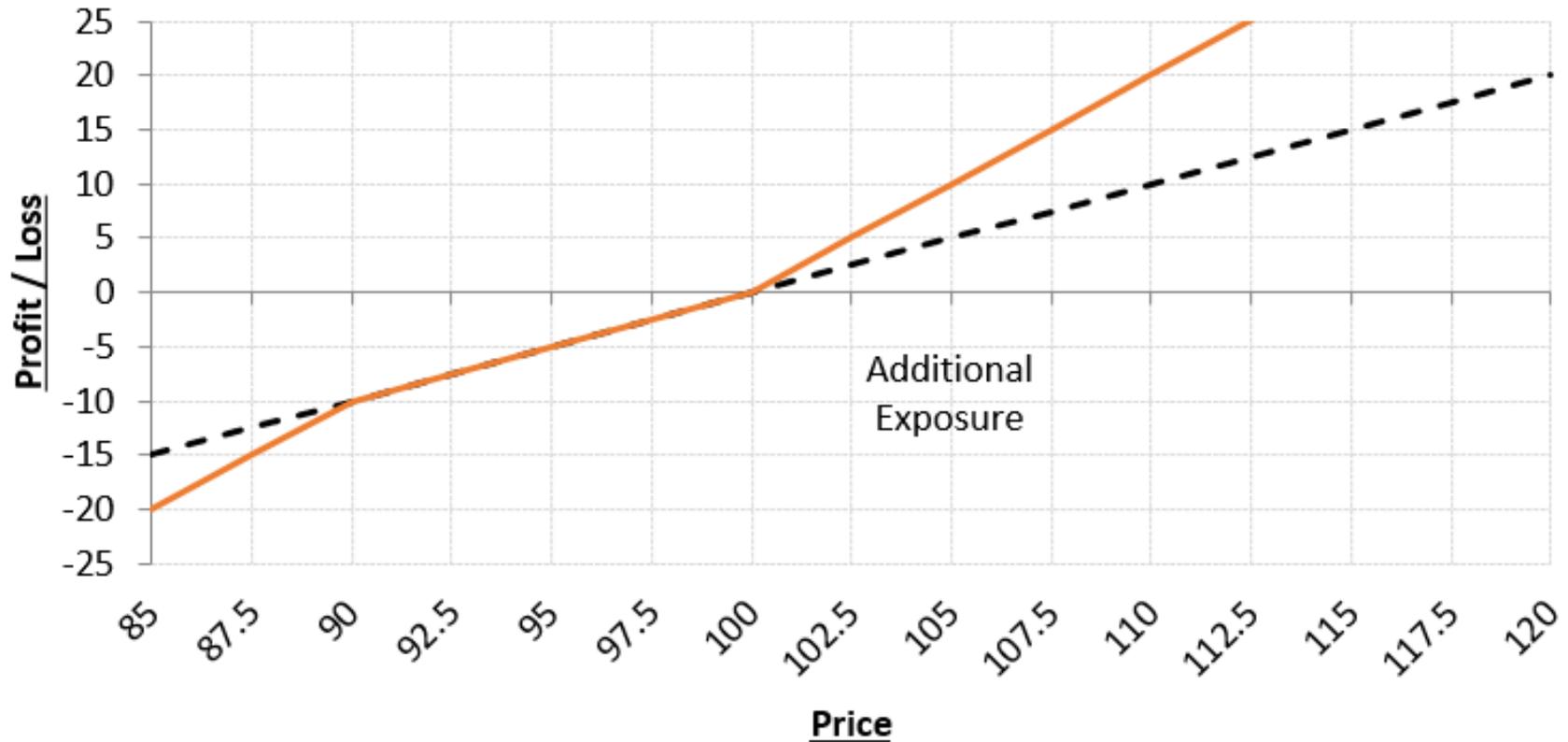




Payoff profiles: Long Fence



Zero Premium 90% - 100% Long Fence + Spot Payoff



- - - Spot Only Payoff

— Combined Spot + Long Fence Payoff



Purpose of fences?



- Fence strategies act as ordinary fences – it keeps deep losses out, by sacrificing some money (or return upside) to put up a fence.
 - Note that for both strategies, the premium collected by selling options partially or fully offset the premium paid to buy the long put.
 - This is known as a combination strategy (specifically, a defensive combination), similar to a collar structure.



Collars



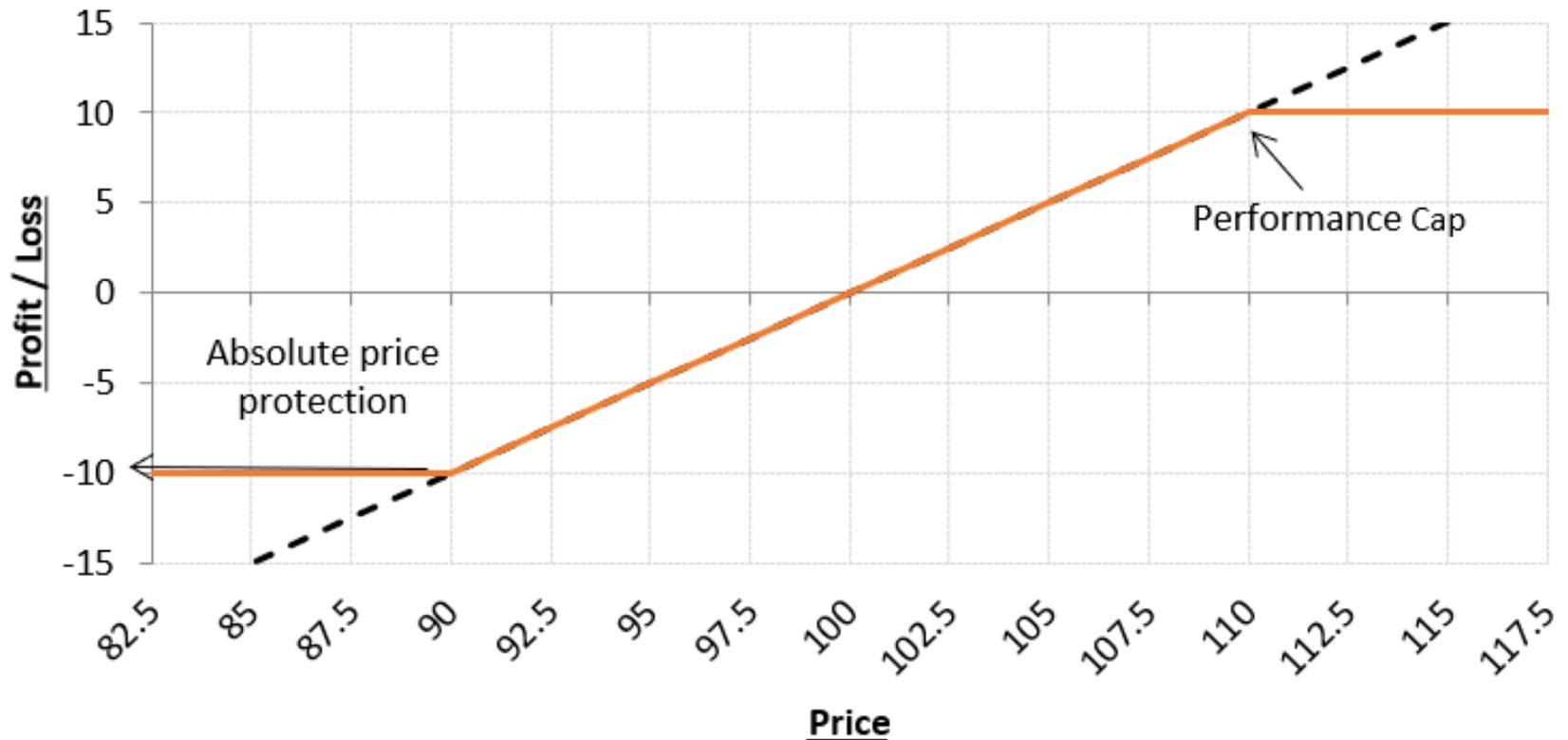
- Collars, similar to fences, hedge large losses by paying up some potential upside – this strategy though **caps losses and gains**.
 - Collars are created by simultaneously buying out-the-money put options that are funded by selling out-the-money call options (same expiration – protective put and covered call).
 - Simply, the put protects the investor from losses, while the call premium sold pays for the put protection.
 - Thus, a collar should entail a limited or zero cost structure (think of it as free insurance, where **the ceiling is what pays for the floor...**)
 - This structure allows an investor a cheap way of mitigating potential large short term movements while maintaining a long-term bullish outlook.



Payoff profiles: Collar



Zero Cost 90% Collar + Spot Payoff



- - - Spot Only Payoff

— Combined Spot + Collar Payoff



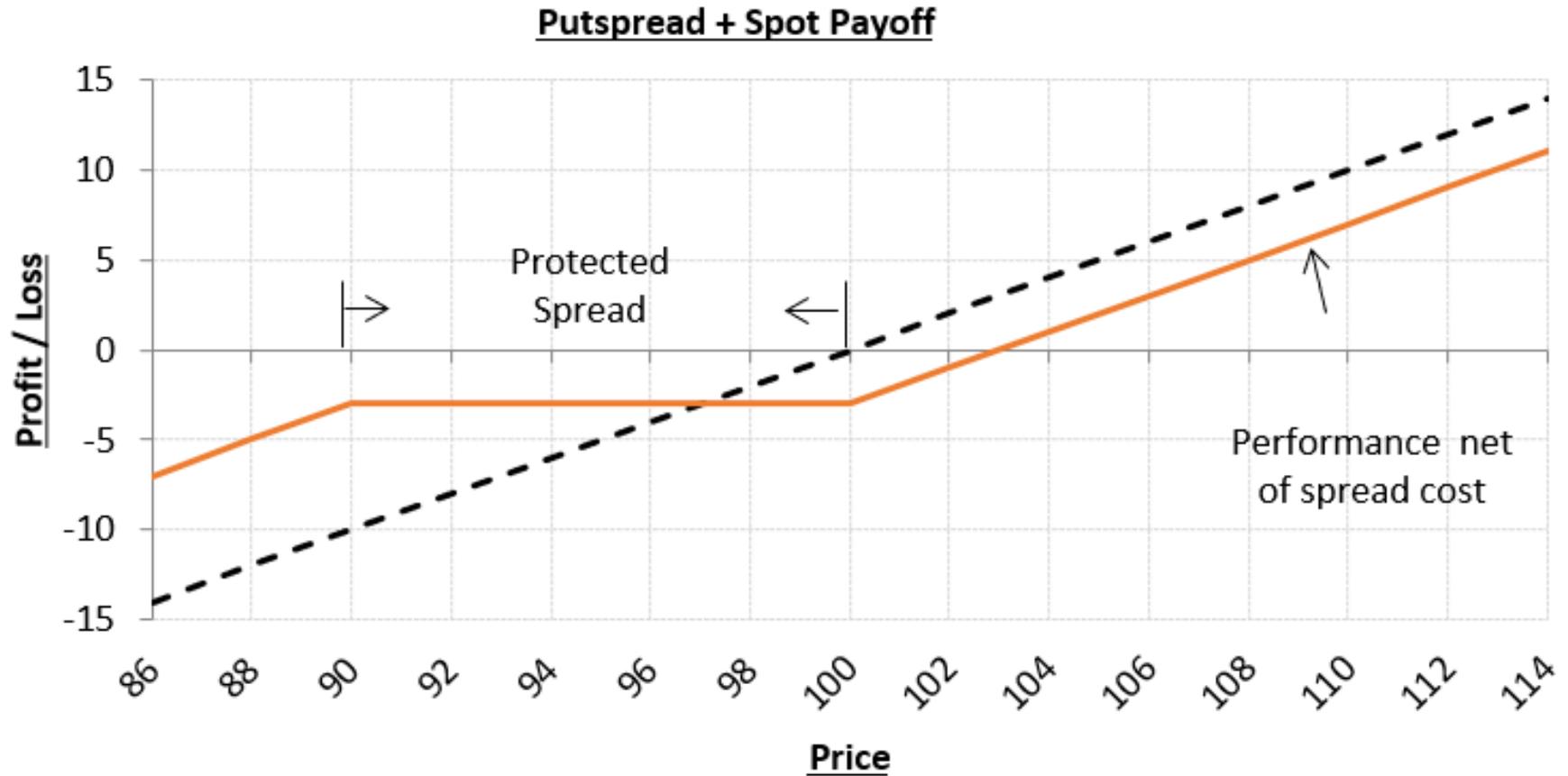
Spreads



- Spreads are used where an investor seeks to limit **some** the downside by capping **some** of the upside
 - Quite similar to a collar – but no hard ceiling / floor.
 - Like collars, these strategies are particularly useful when option premiums are very expensive.
- Put spreads: purchase a put at a specific strike, and then sell the same number of puts at a lower strike price (same underlying and expiration).
- Call spreads: similar, but where you are buying and selling calls

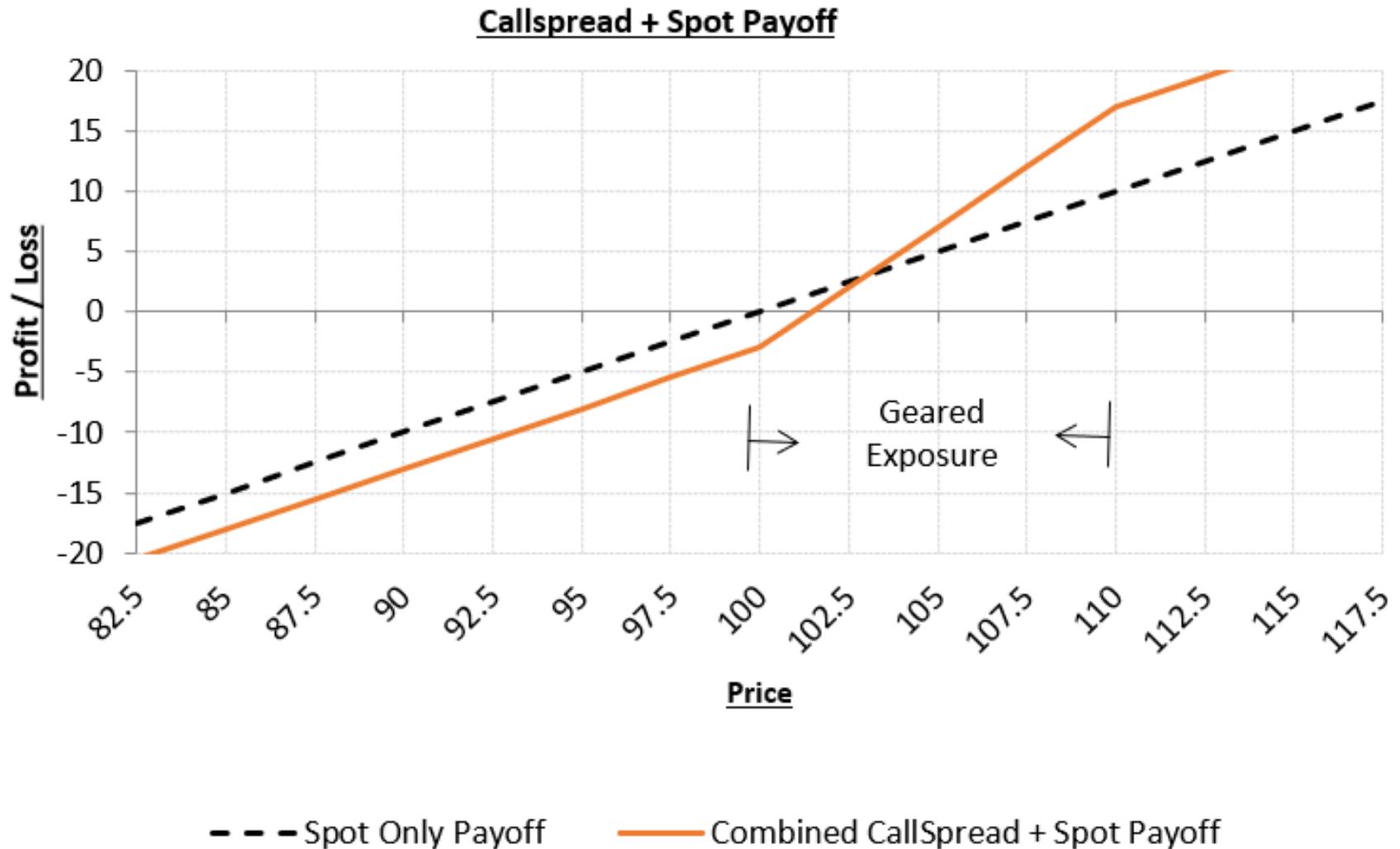


Put spread payoff





Call spread payoff





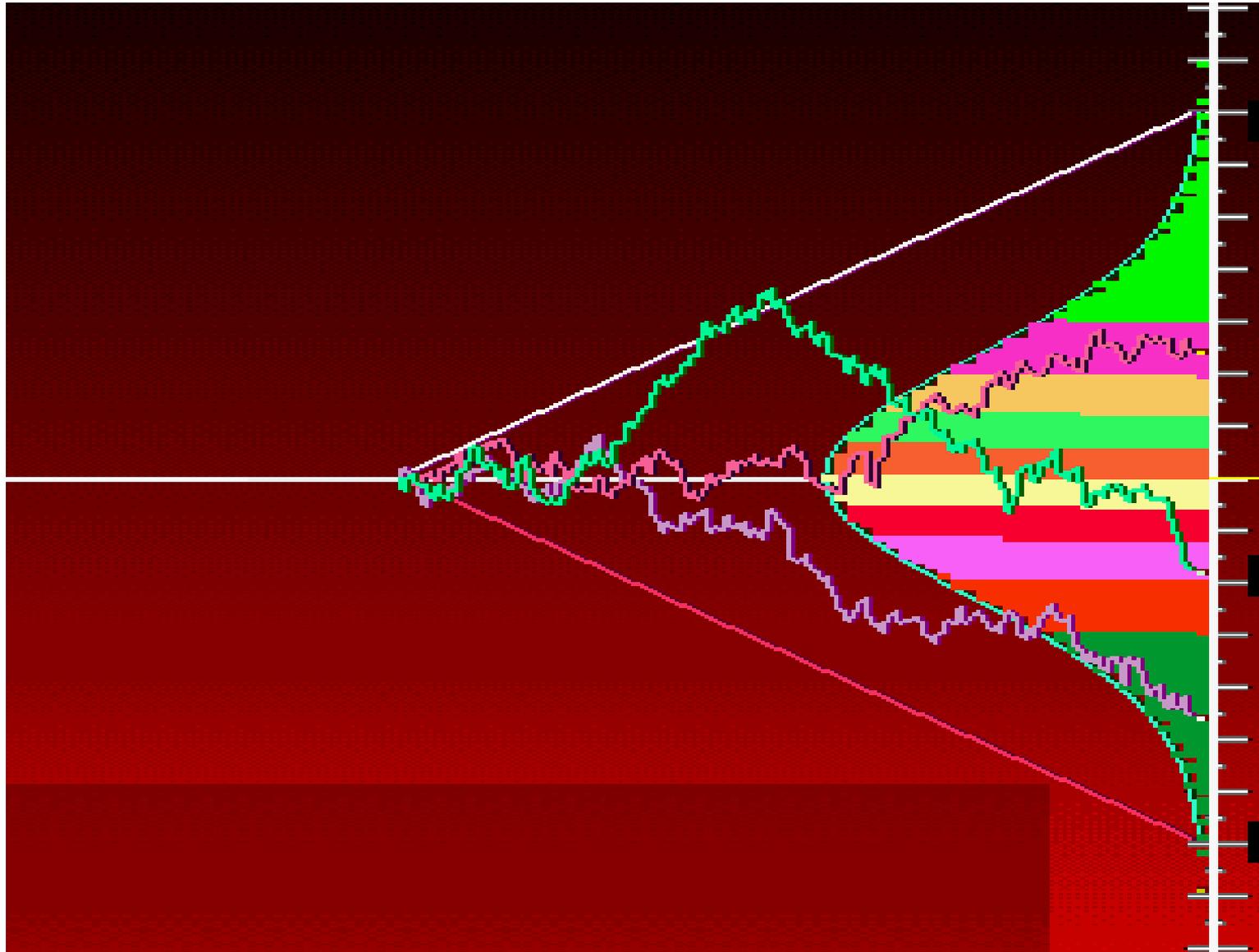
Derivatives providing market information!



- Notice that the premiums on **Options** contracts fluctuate according to the market's sentiments regarding the underlying asset's **outlook and volatility**, and can thus be seen as an indication or **gauge for market sentiment**.
- If the expectation is that volatility will increase in the future → this would imply **increasing premiums**, as the likelihood of a price change in the underlying is larger!
 - At extreme: $\sigma = 0$ would imply no risk premium from prices, although uncertainty as regards inflation, interest rate movements, etc. will still imply an option premium.
- Now as economic / political information is gleaned from the yields on bonds (as seen on the yield curve), **option premiums can be used to provide a subjective measure on how market expectations are regarding future volatility!!**



Volatility...





Option prices



- Option prices can be calculated using the modified Black-Scholes formula after each trading day by the JSE.
- The formula requires several inputs (e.g. the strike price, spot price, maturities, market interest rate, dividend yield, the option type AND then CRUCIALLY – the expected volatility).
- Follow this link to see the formula (in excel) used by the JSE:

<http://www.jse.co.za/bscalc>

Thus:

We can deduce the implied volatility in the market by looking at the option prices of the ALSI, e.g., and calculating what the implied volatility would be...



VIX



- One such measure that uses options pricing to provide information and has gained global popularity, is the Chicago Board Options Exchange (CBOE) Volatility Index, or more commonly known as the **CBOE VIX index**.
- VIX is a measure of volatility based on real-time quotes of S&P 500 **Call** and **Put Options**.
 - It's sometimes called the US equity "**Fear Gauge**" → as the VIX measures expected future fluctuations in the index corresponding to the current bid/ask spreads for index options of the nearest two expiration months.
 - Although the mathematics behind the VIX calculation is rather complex, the final result is a smooth, weighted figure that expresses the range of volatility in the S&P 500 for the next 30 days, a measure called "**implied volatility**."
 - The VIX, basically measures the cost of using options as insurance against losses in the **S&P 500**, hence **fear gauge**.



VIX



- Today, investors can track the VIX directly – as there are several ETFs tracking it.
- As a rule of thumb, **VIX values greater than 30** are generally associated with a large amount of expected volatility as a result of investor fear or uncertainty, while values below 20 generally correspond to less volatile and almost complacent times in the markets.
- The VIX is currently at **14.85** (last year today it was **14.85**), implying there is great uncertainty in the market. This follows as pricing future options instruments are relatively more expensive today than last year this time.
- This value can roughly be interpreted as follows:
 - If the value is 23.53 (like it is today [25/09/2015])
 - The implied movement of prices (up /down) on the S&P 500 over the next 30 days is:

$$\frac{23.53\%}{\sqrt{12}} = 6.79\%$$

The VIX record is 89.53
on October 24 2008



VIX last 12 months



Wild ride for VIX in last year:

“VIX positioning went from incredibly bullish back in February, when the world was coming to an end, to shorts at all time lows. It’s crazy!”



Other gauges



- Other fear gauges include the VNKY for the Nikkei index, or the IVX, used for individual stock volatility measures on the S&P 500.
- **SA has the SAVI index, although it is not nearly as efficient as the VIX!**
 - **It has been around since 2007 (was updated in 2010).**
 - **It is based on the JSE Top 40 companies**
- Also, a Nine day VIX was introduced in 2013 for short term fear gauge:
- This has been done as a result of demand for a higher frequency risk barometer in the US market... See the following article on it:
- <http://www.bloomberg.com/news/2013-10-01/cboe-introduces-nine-day-vix-amid-growing-investor-demand.html>



Profiting off volatility...



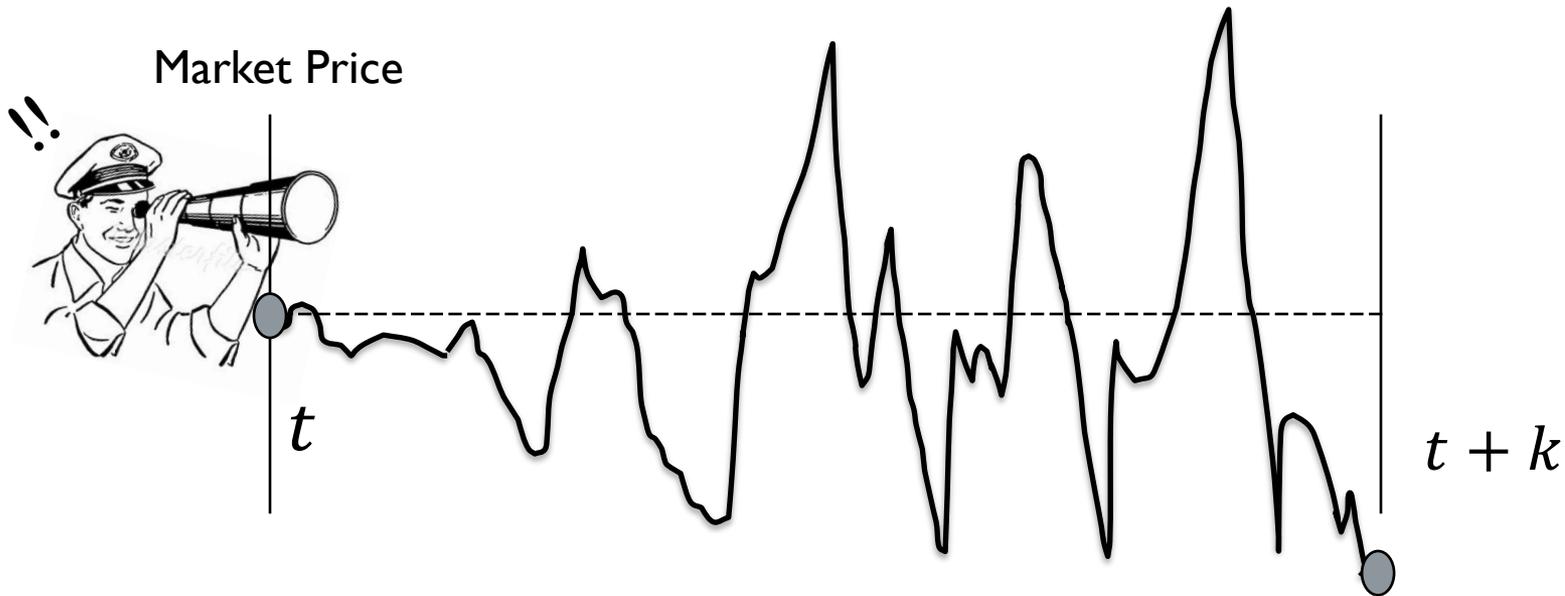
- **Remember: in financial markets, investors can profit off nearly any unique piece of information.**
 - But how can investors profit off **volatility** brewing in the market?
- One way is through indices tracking such measures (e.g. ETFs linked to the Vix). Another is by using derivative techniques to profit off volatility (in either direction).
- One such technique is known as a **straddle strategy**.
- Investors can employ a **long Straddle** to profit off **volatility**, or a **Short straddle** to profit off market **tranquility** (i.e. low future volatility).



Long Straddle Strategy



- To simplify the strategy, suppose first an investor believes that **market volatility** is ahead (perhaps using VIX for index volatility or IVX for individual security volatility, or the SAVI for the JSE).



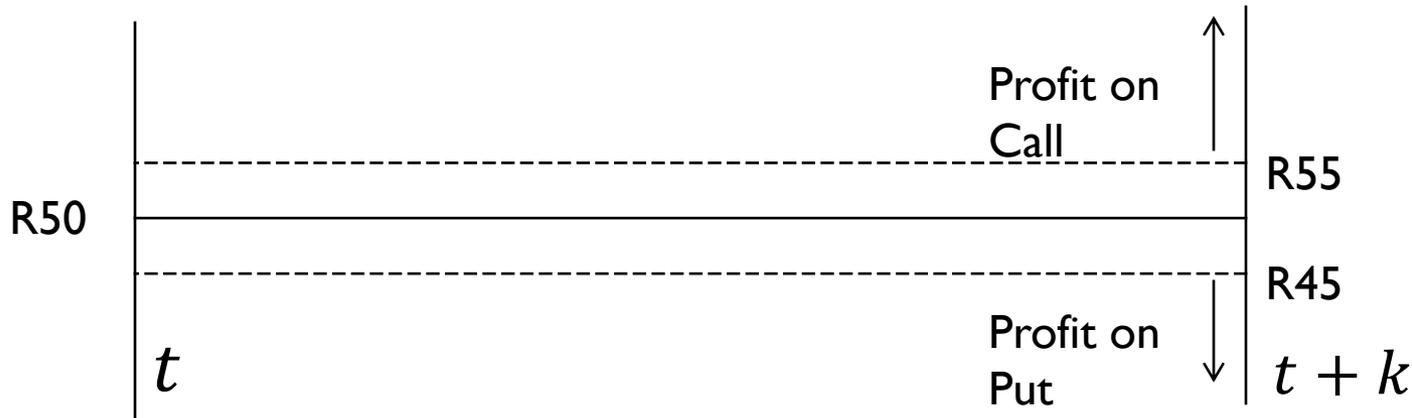
- He could then buy both a Call Option and a Put Option with the exact same Strike Price and Expiration date at $t + k$ to profit off volatility (for dramatic up / down price movements)



Straddle Strategy: illustrated



- Suppose the share's price is currently R50, and the investor holds a long Straddle position. Suppose the premium paid for both Options are R5 each.
- The Straddle position would then look as follows:



- Thus if the share price experiences volatility, and moves either above R55 or below R45, the investor gains profit.
- Suppose the price is R65 at $t + k$ → this would imply him exercising his **Call Option** to buy the shares at R55 and make a profit [Profit A] by selling it immediately (while in the process closing his Put Option)

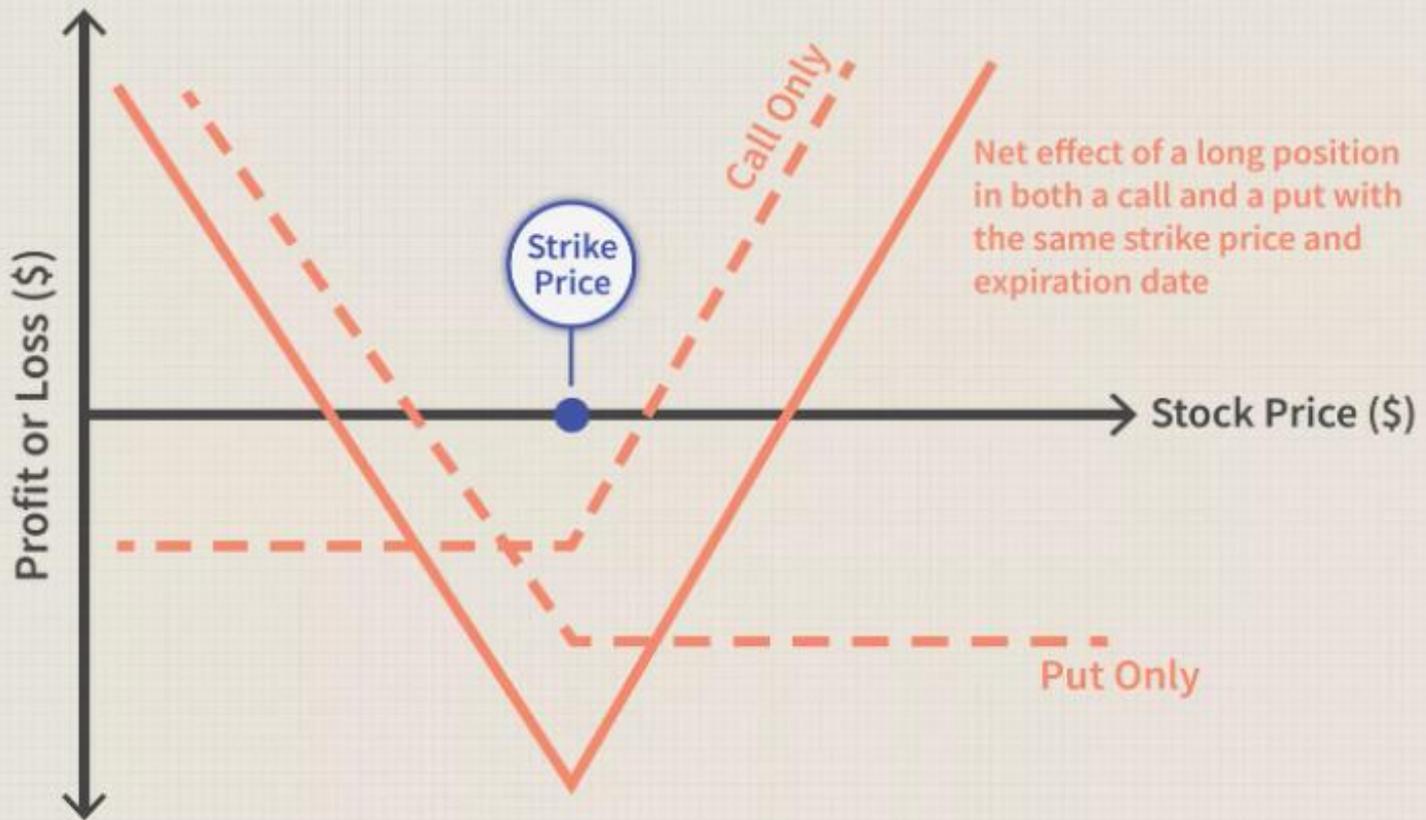


Straddle Strategy



- The opposite will hold for a Short Saddle Strategy, as here the investor expects relative market tranquillity – thereby hoping the price will not fluctuate meaningfully... and profit off this information by **selling** Put and Call Options with the same Strike Price and Expiration date!
 - If prices do not vary much, the investor would be making profits off two premiums – as the buyers of the options sold would not exercise their options...
- Notice that this means investment funds can profit even off relatively stagnant share values!

Straddle Options Strategy



- Payoff structure of a long straddl



Strangle or straddle?



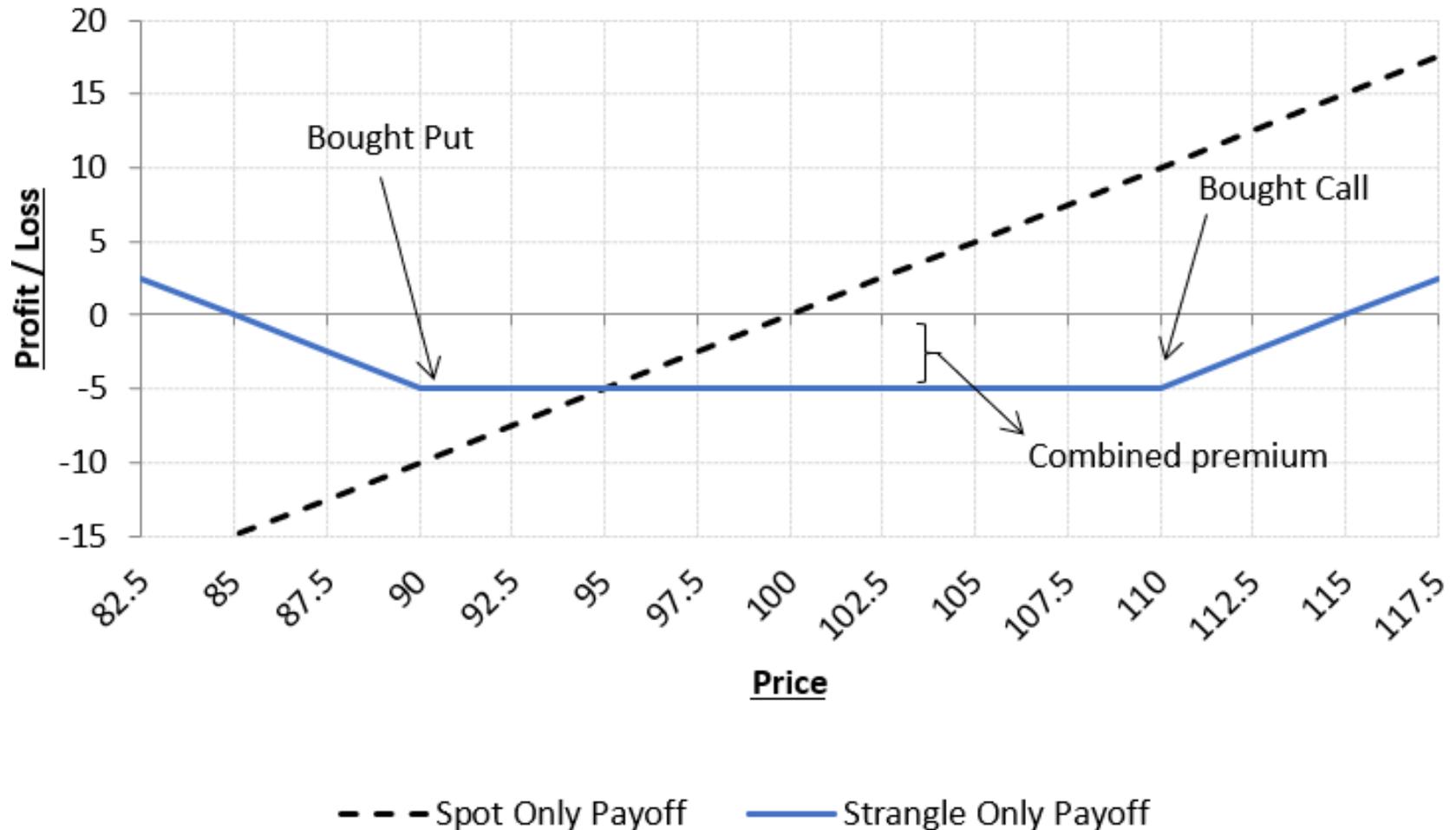
- Strangles are similar to straddles in effectively betting on either high (long) or low (short) vol – but are done by buying and selling simultaneously out-the-money call and put options on same underlying and expiration.
- Strangles generally are cheaper than straddles because the options are out-the-money, and so have the following payoff structure (note it is not as pointy as a straddle)



Long strangle payoff structure



Long 90% & 110% Strangle Only Payoff





UNIVERSITEIT•STELLENBOSCH•UNIVERSITY
jou kennisvenoot • your knowledge partner

Case Study: Herbalife

Short-Selling: Doing it Wrong.



Department of Economics

DEPARTMENT OF
ECONOMICS



Herbalife short sale squeeze



- In the last three years, there has been great media interest in the short-selling craze and public spat regarding Herbalife shares.
- This came after billionaire Hedge Fund manager, Bill Ackman, claimed on the 18th of December 2012 to have uncovered that Herbalife is a **ponzi scheme**.
- Armed with powerpoint presentations, a media invited to attend an important announcement and nearly \$1bn at his disposal, Ackman tried to pull a George Soros on Herbalife.
- i.e. He hoped to expose Herbalife as a fraud, then profit off its demise as he had a short position on more than 20 million, of the 100 million Herbalife shares at \$45 *ps* (nearly a \$1bn position on the shares)



Herbalife short sale squeeze



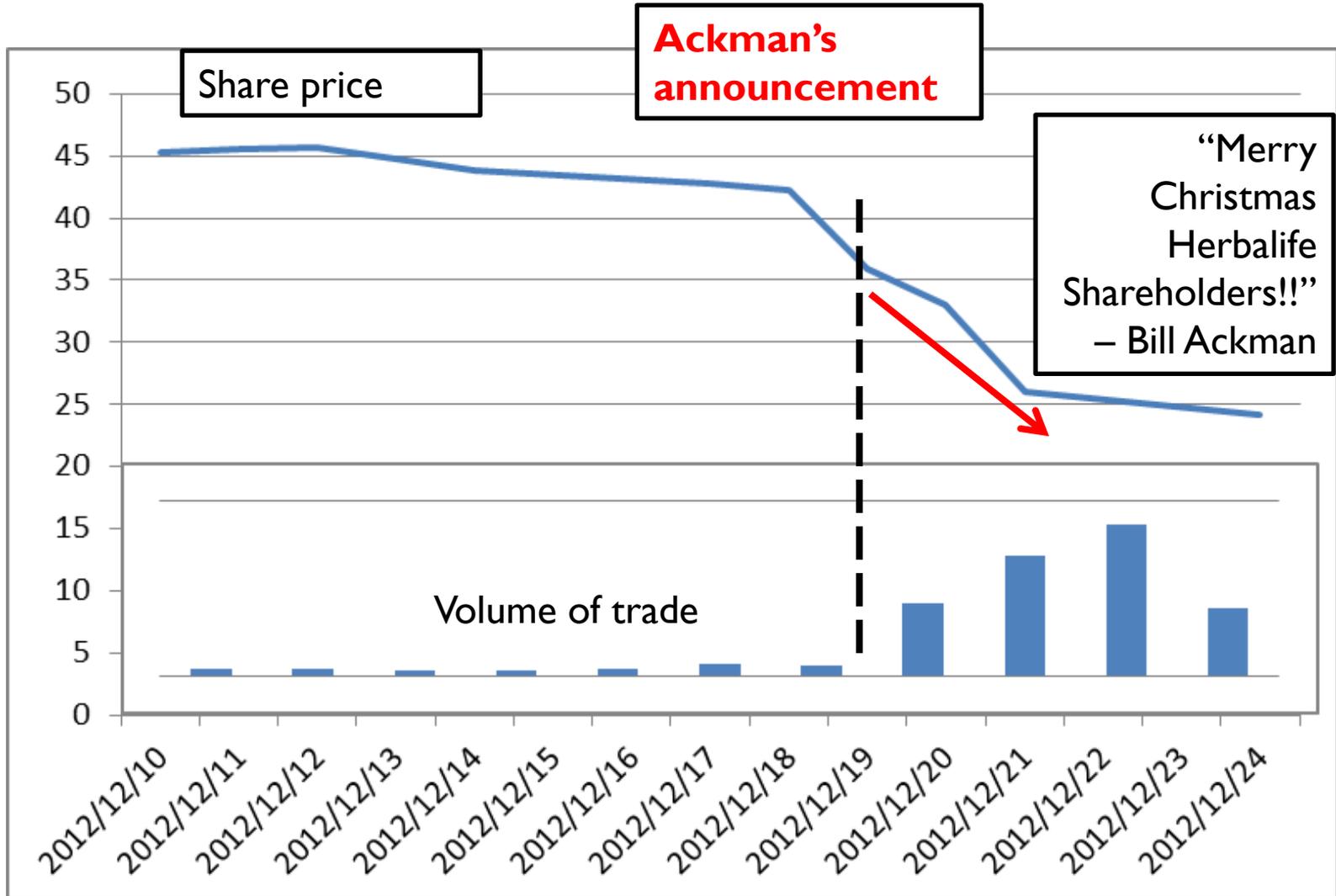
- On December 20 2012, Ackman appeared at a Sohn Investment Conference in New York and accused Herbalife of using “inflated pricing, misleading sales information and a complicated incentive structure to hide a pyramid scheme. He detailed his short strategy in a three hour, 340 slide marathon presentation.
- Naturally, the CEO of Herbalife reacted, calling Ackman disingenuous in his effort to profit off Herbalife’s demise following misleading information from his presentation.
- This did not, however, stop the share price from falling as a result of the über-Bear Ackman– sliding to as low as \$24 in week! (nearly a halving of the share price)
- **All went to plan, so far...**



Ackman



Hlf Shareprice -





Battle of Egos ensued



- Ackman seemed to have convinced the markets, but some were not as easily convinced...
- Another hot shot Hedge Fund manager, Carl Icahn, and Daniel Loeb – both taking the opposite end of Ackman's bet, reviving a decade old feud between the two.
- What followed the announcement was a battle of egos.
- But both could not be right and someone had to lose...
- The stage was set for an epic battle...



Icahn

PHOTO: SARAH R. FRIEDMAN



What transpired...



- Icahn had the following to say about Ackman's stunt:
- "Selling short 20% of the shares of a company such as Herbalife ... leaves much to be questioned."
- He also claimed he does not "like" or "respect" Ackman – questioning his motives on publicizing his Herbalife short sale.
- "You don't go out and get a room full of people to bad-mouth a company".
- Many agreed and accused Ackman of using aggressive tactics to squeeze enormous profits out of his investment.
- (Icahn now holds roughly 17% of Herbalife shares)



FTC in 2016...



- The FTC in the US launched a full-scale investigation into Herbalife's business model. According to a Bloomberg article, while the FTC didn't weigh in on whether Herbalife is a pyramid scheme, its complaint against the company included allegations that it deceived recruits and had a compensation structure that enriched few while the majority of participants made no money.
 - The agency ordered changes to fix those problems and required Herbalife to pay \$200 million to compensate victims.
 - Most, however, believed this spelled the end of the investigation and allegations of it being a pyramid scheme.



FTC in 2016...



- While some investors and analysts saw the settlement as the end of the battle, Ackman saw it as the beginning of a new phase. He reacted to the deal by saying that the changes Herbalife has been ordered to make will cause the company to “collapse.”
- But Icahn responded by buying more shares – according to Bloomberg:
- “I continue to believe in Herbalife: It’s a great model that creates a great number of jobs for people. Ackman may be a smart guy but he has clearly succumbed to the same dangerous (and sometimes fatal) malady that afflicts many investors -- he’s developed a very bad case of ‘Herbalife obsession.’” – Icahn said on his website. This caused the share-price to surge once again, while he also later bought another \$2 million worth of stock in the company.



Ackman kept trying though...



- See this article on what Ackman needed to do in order to shield him from further losses back in late 2013 already, following his initial aggressive approach:

<http://www.zacks.com/stock/news/110979/Herbalife-Dips-on-Ackmans-Short-Position>

<http://www.forbes.com/sites/nathanvardi/2013/10/03/bill-ackmans-herbalife-retreat/>

<http://www.bloomberg.com/news/2013-10-03/herbalife-drops-as-short-squeeze-risk-recedes-with-ackman-puts.html>

- In it, it details how Ackman now **had to cut his bearish wager on Herbalife – buying put options** in an effort to stop the **short squeeze**. This way he is shielded somewhat, but can still profit if the share price falls (as he still hopes proudly for it to happen...)
- **Read the article... After this session I hope you understand its lingo!**



It turned out to rise



- In the end, it turned out that Herbalife was not exposed as a pyramid, its share price **more than doubled** since Ackman took his position, with Ackman exiting all his Herbalife positions in February 2018 – losing more than \$1bn in the five years he tried, but failed, to sink Herbalife... (<https://www.cnbc.com/2018/02/28/ackman-exits-bet-against-herbalife.html>)
- Icahn responded in typical fashion:

“I ENJOY A GOOD FIGHT... ESPECIALLY WHEN I WIN.”
- Even worse (if you are Ackman), Icahn thanked him for alerting him to the stock in the first place by taking his short position:

“The company really is great and Bill Ackman had the wrong idea on it”.



Responses:



- Ackman early on created this website to defame Herbalife:
<https://www.factsaboutherb LIFE.com/>
- Although clearly it didn't work, as seen by the share price not becoming depleted as Ackman hoped.
- Herbalife last year responded by launching their own defaming site (although this has since been removed):
<https://www.businesswire.com/news/home/20160829005711/en/Herbalife-Today-Posts-First-in-a-New-Series-of-Videos-on-TheRealBillAckman.com>